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(54) **ACCESSING LARGE AMOUNTS OF DATA IN A DISPERSED STORAGE NETWORK**

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G06F 11/00 (2006.01)
(Continued)

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CPC ***G06F 11/00*** (2013.01); ***G06F 3/06*** (2013.01); ***G06F 11/1076*** (2013.01); ***H04L 9/085*** (2013.01); ***H04L 9/0863*** (2013.01); ***H04L 9/0869*** (2013.01); ***H04L 9/321*** (2013.01); ***H04L 9/3263*** (2013.01); ***H04L 63/0823*** (2013.01);
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USPC 714/763, E11.034; 709/238, 226
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,092,732	A	5/1978	Ouchi
5,454,101	A	9/1995	Mackay et al.

(Continued)

OTHER PUBLICATIONS

Walraed-Sullivan, Meg., et al., “ALIAS: Scalable, Decentralized Label Assignment for Data Centers,” SOCC’11, Oct. 27-28, 2011, Cascais, Portugal.*

(Continued)

Primary Examiner — Albert Decady
Assistant Examiner — Kyle Vallecillo
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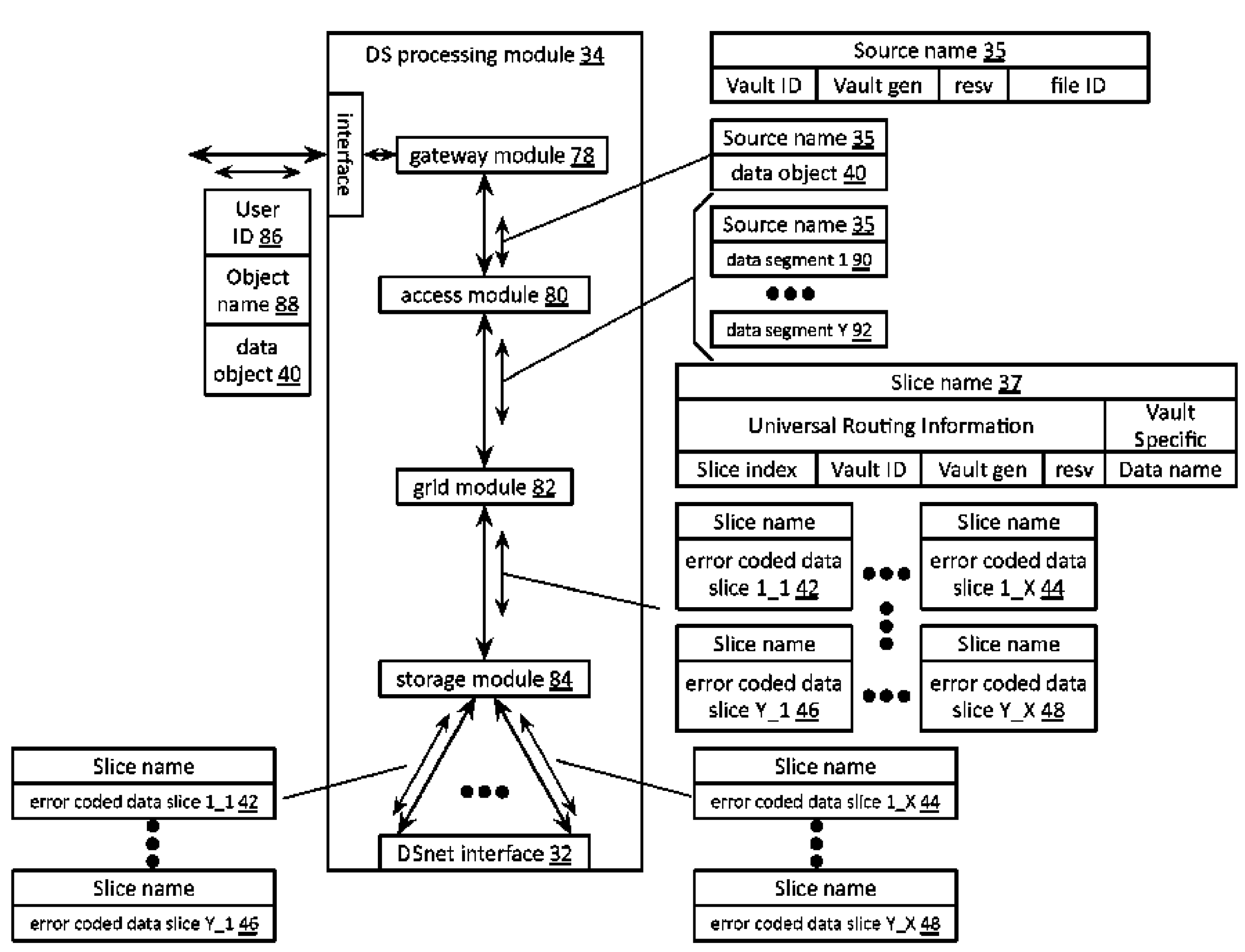
(57) **ABSTRACT**

A method begins by a dispersed storage (DS) processing module obtaining a plurality of data objects for storage in a dispersed storage network (DSN) and determining one or more common data object aspects of a data object of the plurality of data objects. The method continues with the DS processing module disperse storage error encoding at least a portion of the data object to produce a set of encoded data slices and generating a set of DSN addresses for the set of encoded data slices, wherein each of the set of DSN addresses includes a field referencing the one or more common data object aspects. The method continues with the DS processing module outputting the set of encoded data slices for storage in the DSN based on the set of DSN addresses.

18 Claims, 10 Drawing Sheets



(51) **Int. Cl.**
H04L 9/32 (2006.01)
H04L 29/06 (2006.01)
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G06F 3/06 (2006.01)
G06F 11/10 (2006.01)
G06F 21/33 (2013.01)
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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,463,765 A * 10/1995 Kakuta et al. 714/6.12
5,485,474 A 1/1996 Rabin
5,774,643 A 6/1998 Lubbers et al.
5,802,364 A 9/1998 Senator et al.
5,809,285 A 9/1998 Hilland
5,890,156 A 3/1999 Rekieta et al.
5,987,622 A 11/1999 Lo Verso et al.
5,991,414 A 11/1999 Garay et al.
6,012,159 A 1/2000 Fischer et al.
6,058,454 A 5/2000 Gerlach et al.
6,128,277 A 10/2000 Bruck et al.
6,175,571 B1 1/2001 Haddock et al.
6,192,472 B1 2/2001 Garay et al.
6,256,688 B1 7/2001 Suetaka et al.
6,272,658 B1 8/2001 Steele et al.
6,301,604 B1 10/2001 Nojima
6,356,949 B1 3/2002 Katsandres et al.
6,366,995 B1 4/2002 Vilkov et al.
6,374,336 B1 4/2002 Peters et al.
6,415,373 B1 7/2002 Peters et al.
6,418,539 B1 7/2002 Walker
6,449,688 B1 9/2002 Peters et al.
6,567,948 B2 5/2003 Steele et al.
6,571,282 B1 5/2003 Bowman-Amuah
6,609,223 B1 8/2003 Wolfgang
6,718,361 B1 4/2004 Basani et al.
6,760,808 B2 7/2004 Peters et al.
6,785,768 B2 8/2004 Peters et al.
6,785,783 B2 8/2004 Buckland
6,826,711 B2 11/2004 Moulton et al.
6,879,596 B1 4/2005 Dooply
7,003,688 B1 2/2006 Pittelkow et al.
7,024,451 B2 4/2006 Jorgenson
7,024,609 B2 4/2006 Wolfgang et al.
7,080,101 B1 7/2006 Watson et al.
7,103,824 B2 9/2006 Halford
7,103,915 B2 9/2006 Redlich et al.
7,111,115 B2 9/2006 Peters et al.
7,140,044 B2 11/2006 Redlich et al.
7,146,644 B2 12/2006 Redlich et al.
7,171,493 B2 1/2007 Shu et al.
7,222,133 B1 5/2007 Raipurkar et al.
7,240,236 B2 7/2007 Cutts et al.
7,272,613 B2 9/2007 Sim et al.
7,636,724 B2 12/2009 de la Torre et al.
2002/0062422 A1 5/2002 Butterworth et al.
2002/0166079 A1 11/2002 Ulrich et al.
2003/0018927 A1 1/2003 Gadir et al.
2003/0037261 A1 2/2003 Meffert et al.
2003/0065617 A1 4/2003 Watkins et al.
2003/0084020 A1 5/2003 Shu
2004/0024963 A1 2/2004 Talagala et al.
2004/0122917 A1 6/2004 Menon et al.
2004/0215998 A1 10/2004 Buxton et al.
2004/0228493 A1 11/2004 Ma et al.
2005/0100022 A1 5/2005 Ramprashad
2005/0114594 A1 5/2005 Corbett et al.
2005/0125593 A1 6/2005 Karpoff et al.
2005/0131993 A1 6/2005 Fatula, Jr.
2005/0132070 A1 6/2005 Redlich et al.
2005/0144382 A1 6/2005 Schmisseur
2005/0229069 A1 10/2005 Hassner
2006/0047907 A1 3/2006 Shiga et al.
2006/0136448 A1 6/2006 Cialini et al.
2006/0156059 A1 7/2006 Kitamura
2006/0224603 A1 10/2006 Correll, Jr.
2007/0079081 A1 4/2007 Gladwin et al.
2007/0079082 A1 4/2007 Gladwin et al.
2007/0079083 A1 4/2007 Gladwin et al.
2007/0088970 A1 4/2007 Buxton et al.
2007/0168634 A1* 7/2007 Morishita et al. 711/170
2007/0174192 A1 7/2007 Gladwin et al.
2007/0214285 A1 9/2007 Au et al.
2007/0234110 A1 10/2007 Soran et al.
2007/0283167 A1 12/2007 Venters, III et al.
2008/0040505 A1* 2/2008 Britto et al. 709/238
2008/0065827 A1* 3/2008 Byrne et al. 711/114
2008/0183975 A1* 7/2008 Foster et al. 711/153
2009/0094251 A1 4/2009 Gladwin et al.
2009/0094318 A1 4/2009 Gladwin et al.
2010/0023524 A1 1/2010 Gladwin et al.

OTHER PUBLICATIONS

Shamir; How to Share a Secret; Communications of the ACM; vol. 22, No. 11; Nov. 1979; pp. 612-613.
Rabin; Efficient Dispersal of Information for Security, Load Balancing, and Fault Tolerance; Journal of the Association for Computer Machinery; vol. 36, No. 2; Apr. 1989; pp. 335-348.
Chung; An Automatic Data Segmentation Method for 3D Measured Data Points; National Taiwan University; pp. 1-8; 1998.
Plank, T1: Erasure Codes for Storage Applications; FAST2005, 4th Usenix Conference on File Storage Technologies; Dec. 13-16, 2005; pp. 1-74.
Wildi; Java iSCSi Initiator; Master Thesis; Department of Computer and Information Science, University of Konstanz; Feb. 2007; 60 pgs.
Legg; Lightweight Directory Access Protocol (LDAP): Syntaxes and Matching Rules; IETF Network Working Group; RFC 4517; Jun. 2006; pp. 1-50.
Zeilenga; Lightweight Directory Access Protocol (LDAP): Internationalized String Preparation; IETF Network Working Group; RFC 4518; Jun. 2006; pp. 1-14.
Smith; Lightweight Directory Access Protocol (LDAP): Uniform Resource Locator; IETF Network Working Group; RFC 4516; Jun. 2006; pp. 1-15.
Smith; Lightweight Directory Access Protocol (LDAP): String Representation of Search Filters; IETF Network Working Group; RFC 4515; Jun. 2006; pp. 1-12.
Zeilenga; Lightweight Directory Access Protocol (LDAP): Directory Information Models; IETF Network Working Group; RFC 4512; Jun. 2006; pp. 1-49.
Sciberras; Lightweight Directory Access Protocol (LDAP): Schema for User Applications; IETF Network Working Group; RFC 4519; Jun. 2006; pp. 1-33.
Harrison; Lightweight Directory Access Protocol (LDAP): Authentication Methods and Security Mechanisms; IETF Network Working Group; RFC 4513; Jun. 2006; pp. 1-32.
Zeilenga; Lightweight Directory Access Protocol (LDAP): Technical Specification Road Map; IETF Network Working Group; RFC 4510; Jun. 2006; pp. 1-8.
Zeilenga; Lightweight Directory Access Protocol (LDAP): String Representation of Distinguished Names; IETF Network Working Group; RFC 4514; Jun. 2006; pp. 1-15.
Sermersheim; Lightweight Directory Access Protocol (LDAP): The Protocol; IETF Network Working Group; RFC 4511; Jun. 2006; pp. 1-68.
Satran, et al.; Internet Small Computer Systems Interface (iSCSI); IETF Network Working Group; RFC 3720; Apr. 2004; pp. 1-257.

(56) **References Cited**

OTHER PUBLICATIONS

Xin, et al.; Evaluation of Distributed Recovery in Large-Scale Storage Systems; 13th IEEE International Symposium on High Performance Distributed Computing; Jun. 2004; pp. 172-181.

Kubiatowicz, et al.; OceanStore: An Architecture for Global-Scale Persistent Storage; Proceedings of the Ninth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 2000); Nov. 2000; pp. 1-12.

* cited by examiner

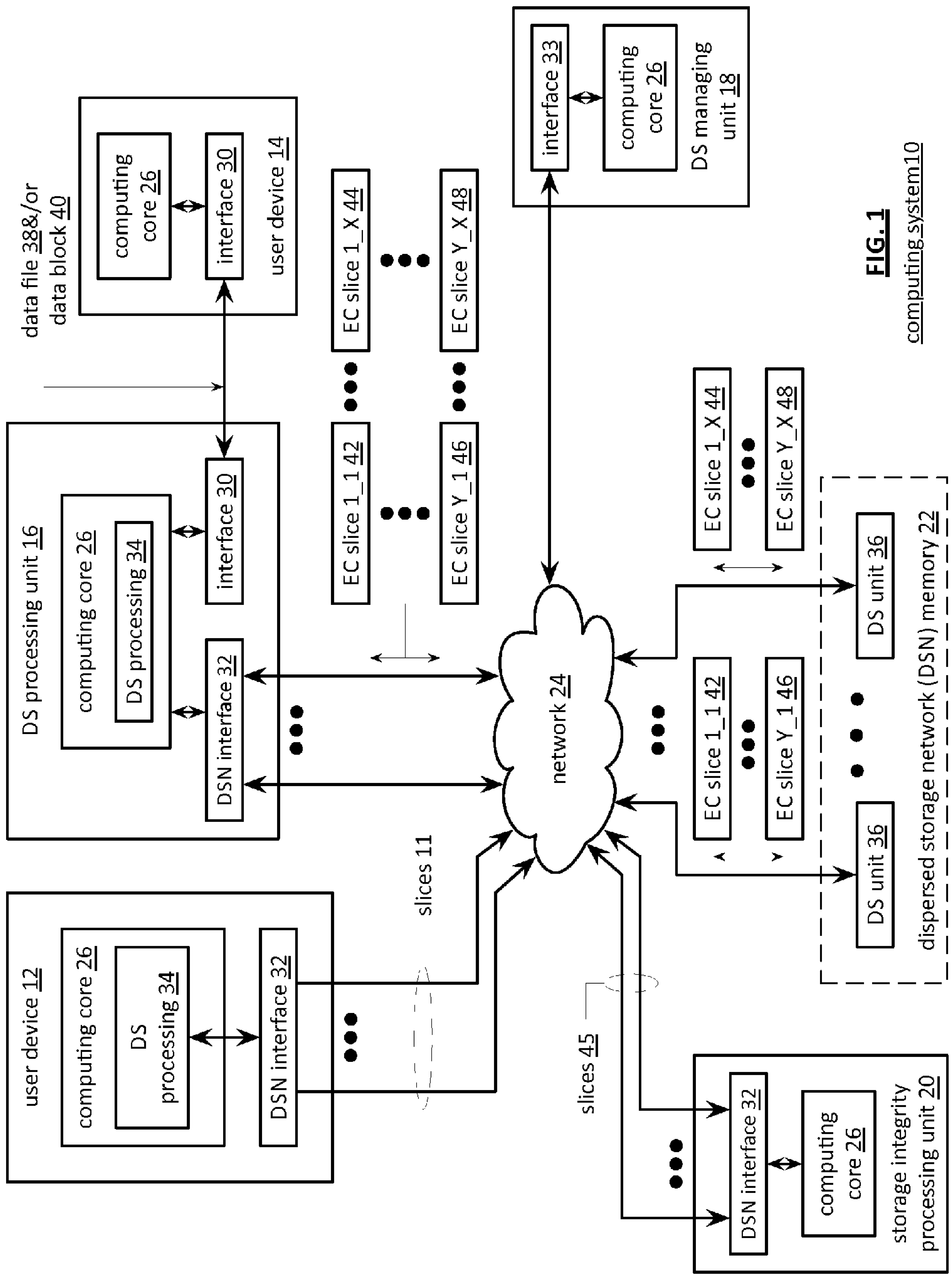

FIG. 1
computing system10

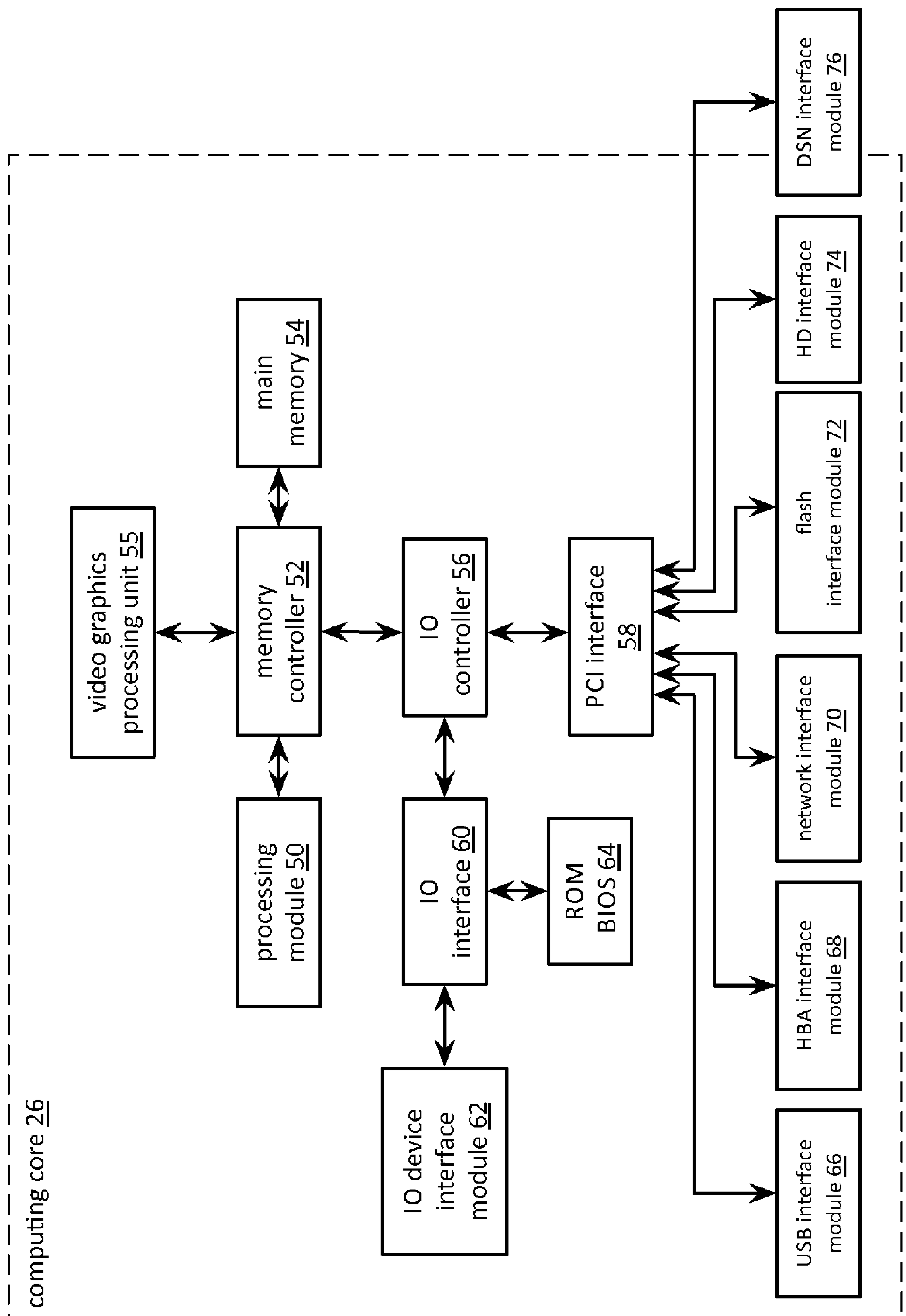
computing core 26
video graphics processing unit 55
memory controller 52
main memory 54
processing module 50
IO controller 56
IO interface 60
ROM BIOS 64
IO device interface module 62
PCI interface 58
USB interface module 66
HBA interface module 68
network interface module 70
flash interface module 72
HD interface module 74
DSN interface module 76

FIG.2

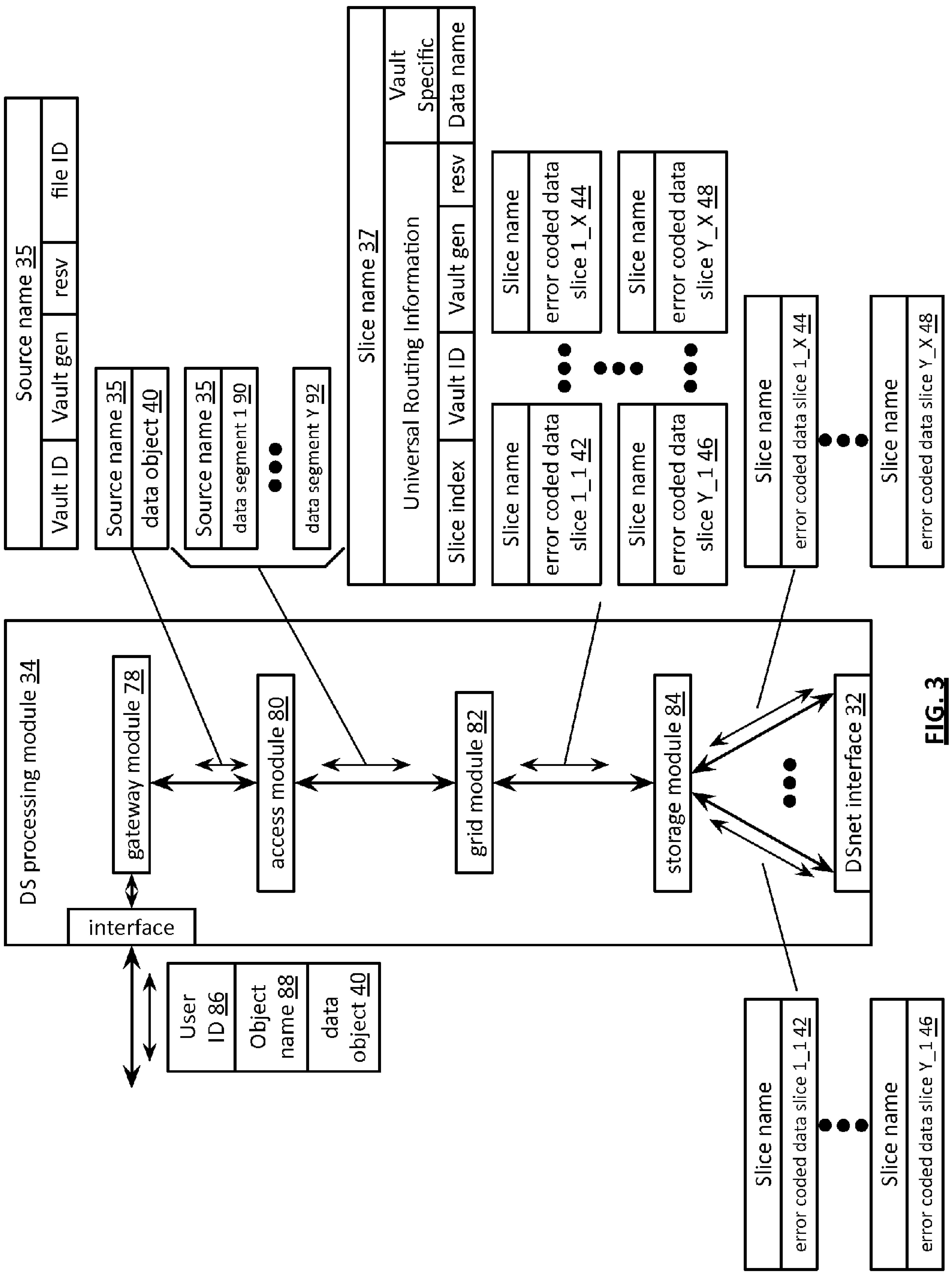
DS processing module 34
interface
gateway module 78
access module 80
grid module 82
storage module 84
DSnet interface 32
User ID 86
Object name 88
data object 40
Source name 35
Vault ID
Vault gen
resv
file ID
Source name 35
data object 40
Source name 35
data segment 1 90
data segment Y 92
Slice name 37
Universal Routing Information
Vault Specific Data name
Slice index
Vault ID
Vault gen
resv
Slice name
error coded data slice 1_1 42
Slice name
error coded data slice 1_X 44
Slice name
error coded data slice Y_1 46
Slice name
error coded data slice Y_X 48

FIG. 3

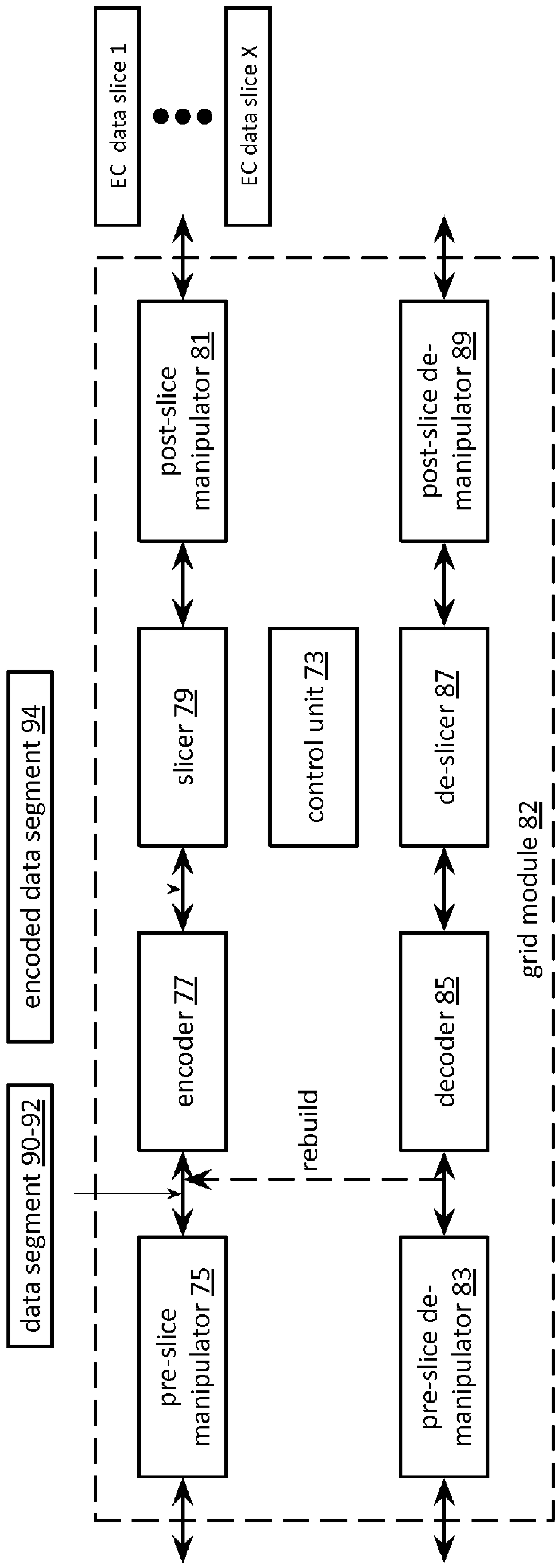
EC data slice 1
EC data slice X
data segment 90-92
encoded data segment 94
pre-slice manipulator 75
encoder 77
slicer 79
post-slice manipulator 81
control unit 73
rebuild
pre-slice de-manipulator 83
decoder 85
de-slicer 87
post-slice de-manipulator 89
grid module 82

FIG. 4

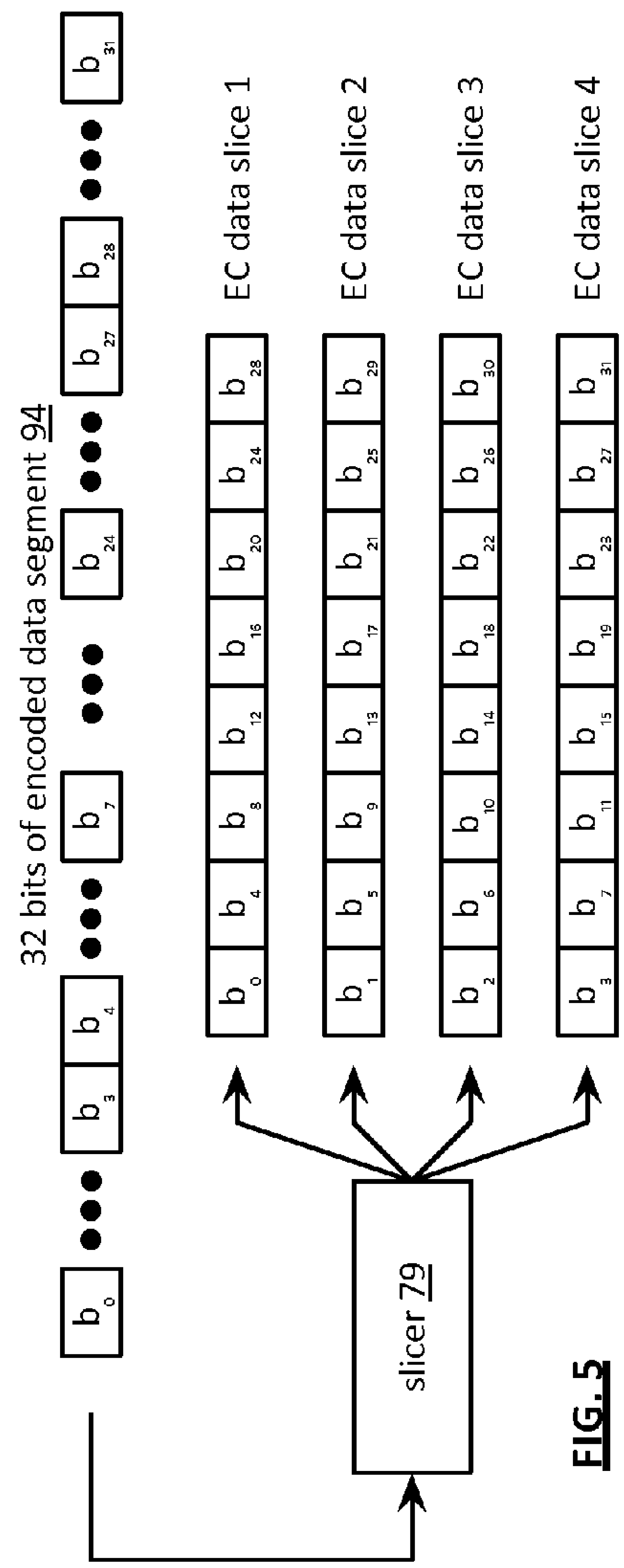
32 bits of encoded data segment 94
slicer 79
EC data slice 1
EC data slice 2
EC data slice 3
EC data slice 4

FIG. 5

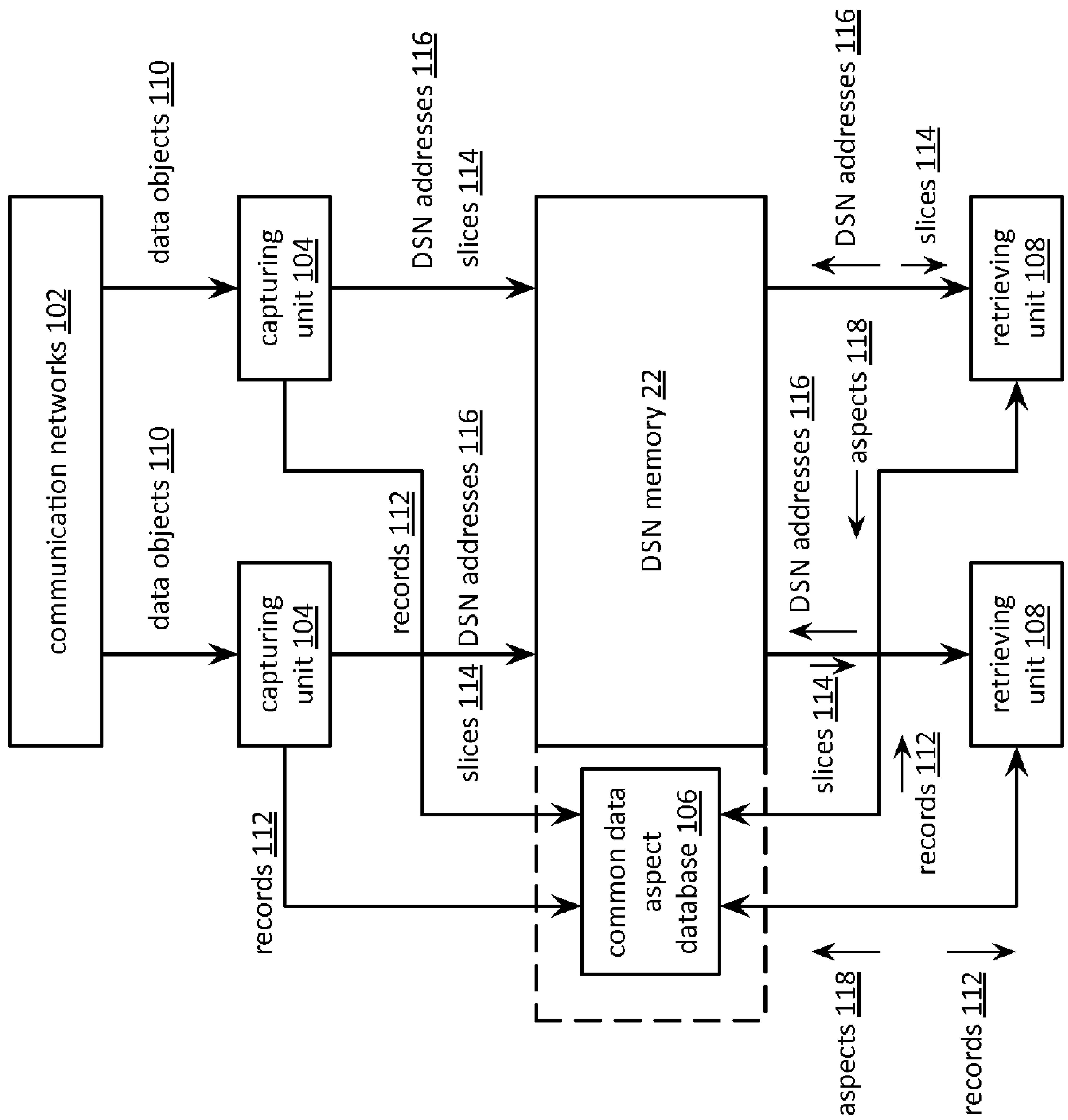
communication networks 102
data objects 110
data objects 110
capturing unit 104
capturing unit 104
DSN addresses 116
slices 114
records 112
DSN addresses 116
slices 114
records 112
DSN memory 22
common data aspect database 106
DSN addresses 116
slices 114
aspects 118
DSN addresses 116
slices 114
records 112
aspects 118
records 112
retrieving unit 108
retrieving unit 108

FIG. 6A

FIG. 6B

<table>
<tr><td colspan="5">slice name <u>120</u></td></tr>
<tr><td rowspan="3">slice index <u>122</u></td><td colspan="4">vault source name <u>124</u></td></tr>
<tr><td colspan="3">source name <u>126</u></td><td rowspan="2">segment number <u>128</u></td></tr>
<tr><td>vault ID <u>130</u></td><td>gen <u>132</u></td><td>object number <u>134</u></td></tr>
</table>

FIG. 6C

source name <u>126</u> or object number <u>134</u>	
data object aspect field <u>136</u>	data object ID <u>138</u>
A	1
A	2
B	1
A	3
B	2
2012 July 16 7:00-8:00	1
2012 July 16 7:00-8:00	2
2012 July 16 8:00-9:00	1
2012 July 16 8:00-9:00	2
2012 July 16 8:00-9:00	hash of data ID 457

•••

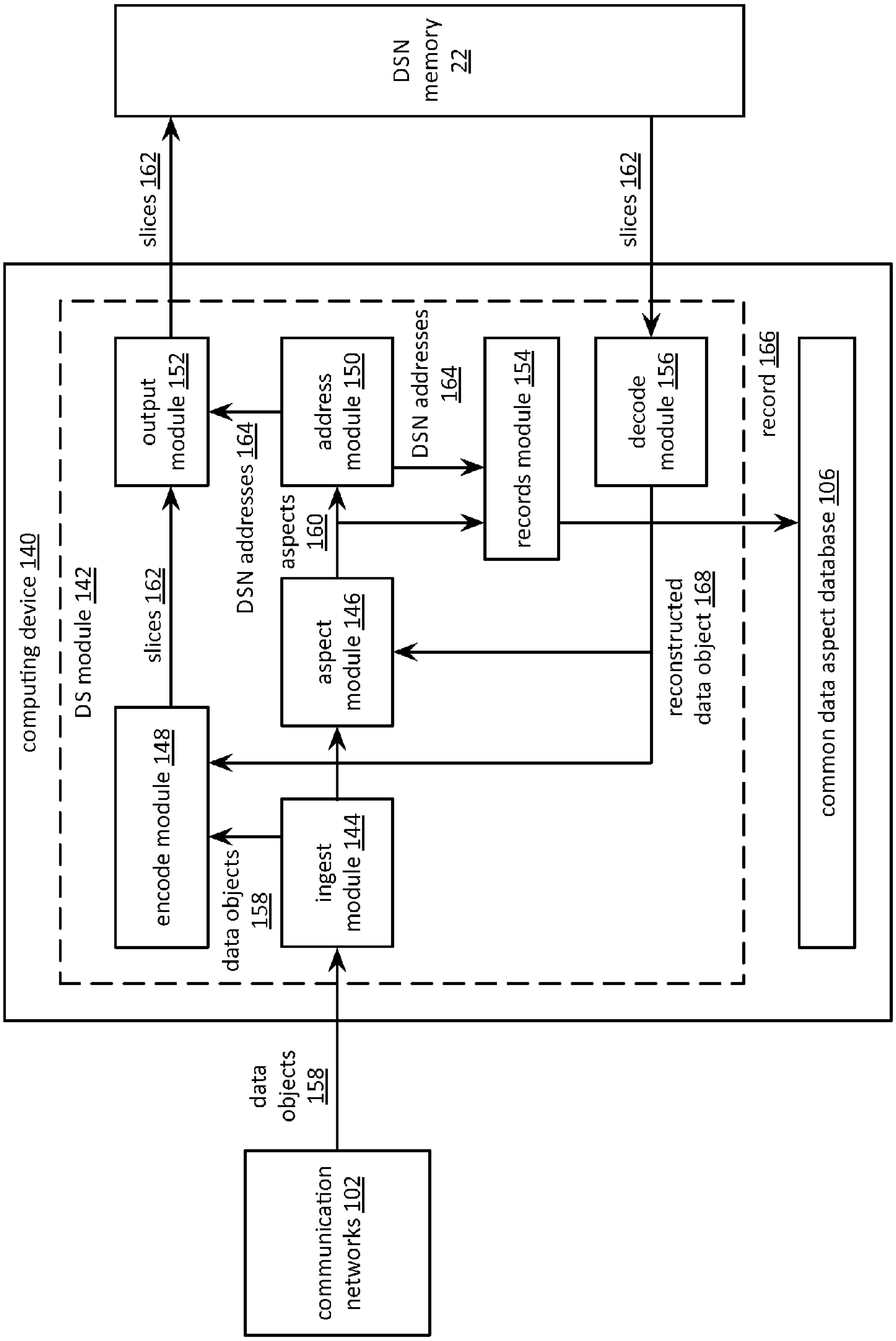
DSN memory 22
slices 162
slices 162
computing device 140
DS module 142
output module 152
address module 150
DSN addresses 164
DSN addresses 164
records module 154
decode module 156
record 166
slices 162
aspects 160
aspect module 146
reconstructed data object 168
encode module 148
ingest module 144
data objects 158
common data aspect database 106
data objects 158
communication networks 102

FIG. 6D

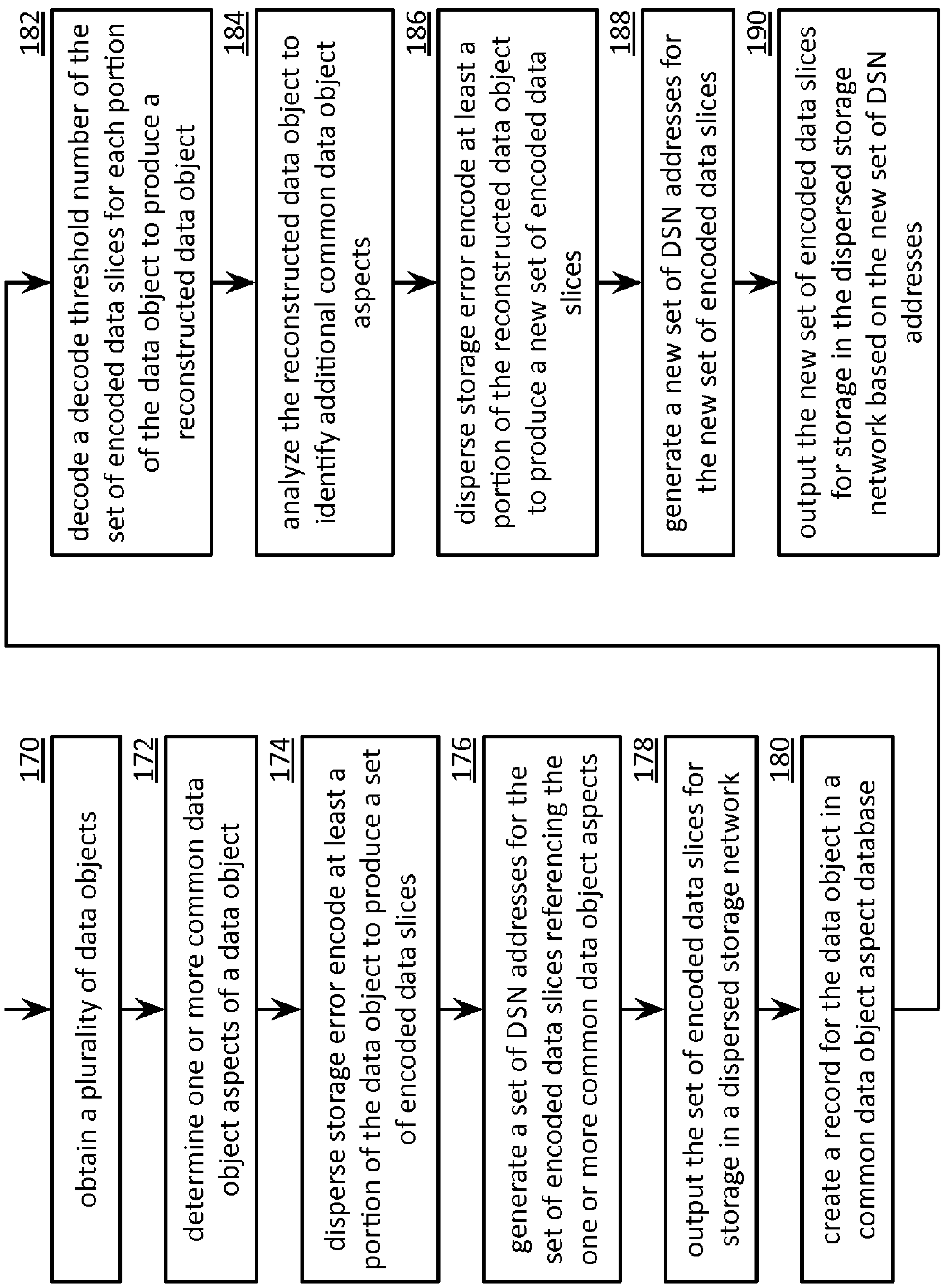
obtain a plurality of data objects
170
determine one or more common data object aspects of a data object
172
disperse storage error encode at least a portion of the data object to produce a set of encoded data slices
174
generate a set of DSN addresses for the set of encoded data slices referencing the one or more common data object aspects
176
output the set of encoded data slices for storage in a dispersed storage network
178
create a record for the data object in a common data object aspect database
180
decode a decode threshold number of the set of encoded data slices for each portion of the data object to produce a reconstructed data object
182
analyze the reconstructed data object to identify additional common data object aspects
184
disperse storage error encode at least a portion of the reconstructed data object to produce a new set of encoded data slices
186
generate a new set of DSN addresses for the new set of encoded data slices
188
output the new set of encoded data slices for storage in the dispersed storage network based on the new set of DSN addresses
190

FIG. 6E

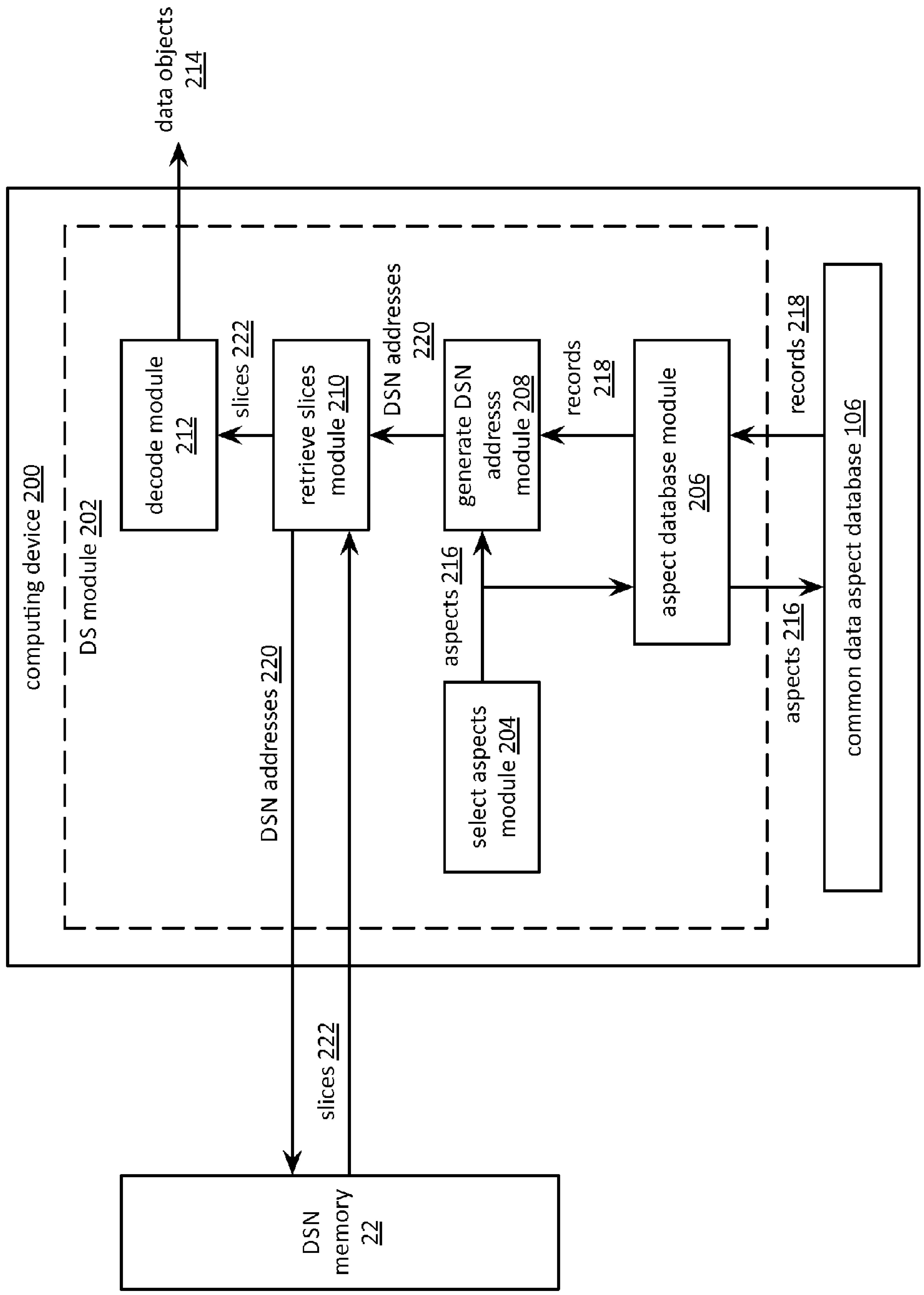
data objects 214
computing device 200
DS module 202
decode module 212
slices 222
retrieve slices module 210
DSN addresses 220
generate DSN addresss module 208
records 218
aspect database module 206
records 218
common data aspect database 106
aspects 216
aspects 216
select aspects module 204
DSN addresses 220
slices 222
DSN memory 22

FIG. 6F

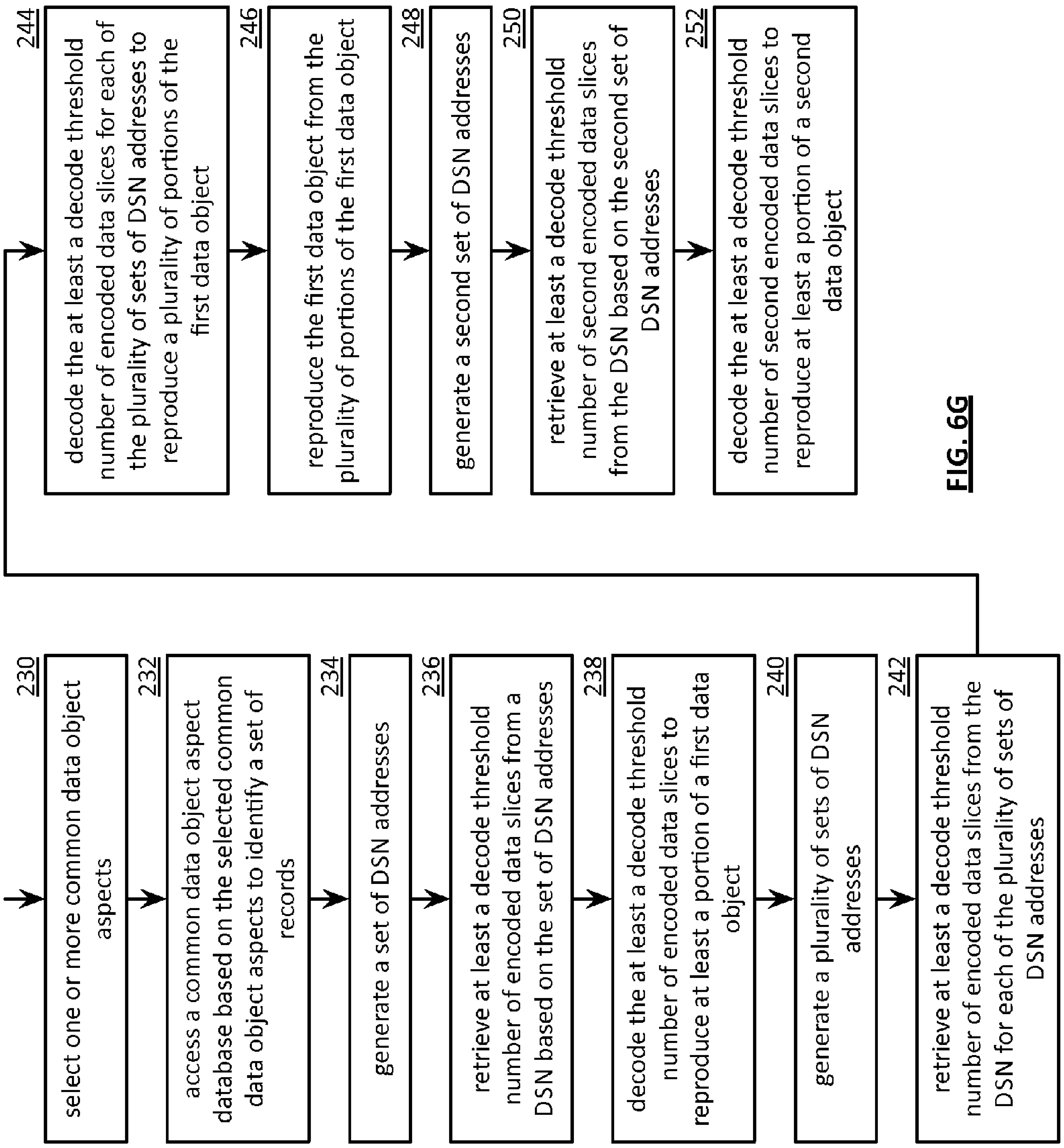
select one or more common data object aspects
230
access a common data object aspect database based on the selected common data object aspects to identify a set of records
232
generate a set of DSN addresses
234
retrieve at least a decode threshold number of encoded data slices from a DSN based on the set of DSN addresses
236
decode the at least a decode threshold number of encoded data slices to reproduce at least a portion of a first data object
238
generate a plurality of sets of DSN addresses
240
retrieve at least a decode threshold number of encoded data slices from the DSN for each of the plurality of sets of DSN addresses
242
decode the at least a decode threshold number of encoded data slices for each of the plurality of sets of DSN addresses to reproduce a plurality of portions of the first data object
244
reproduce the first data object from the plurality of portions of the first data object
246
generate a second set of DSN addresses
248
retrieve at least a decode threshold number of second encoded data slices from the DSN based on the second set of DSN addresses
250
decode the at least a decode threshold number of second encoded data slices to reproduce at least a portion of a second data object
252

FIG. 6G

ACCESSING LARGE AMOUNTS OF DATA IN A DISPERSED STORAGE NETWORK

CROSS REFERENCE TO RELATED PATENTS

The present U.S. Utility Patent Application claims priority pursuant to 35 U.S.C. §119(e) to U.S. Provisional Application No. 61/542,923, entitled "Storing Passwords in a Dispersed Credential Storage System" filed Oct. 4, 2011, which is incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

This invention was made with Government support under Contract No. 2009*0674524*000 awarded by the Central Intelligence Agency. The Government has certain rights in the invention.

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

Not applicable

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

This invention relates generally to computing systems and more particularly to data storage solutions within such computing systems.

2. Description of Related Art

Computers are known to communicate, process, and store data. Such computers range from wireless smart phones to data centers that support millions of web searches, stock trades, or on-line purchases every day. In general, a computing system generates data and/or manipulates data from one form into another. For instance, an image sensor of the computing system generates raw picture data and, using an image compression program (e.g., JPEG, MPEG, etc.), the computing system manipulates the raw picture data into a standardized compressed image.

With continued advances in processing speed and communication speed, computers are capable of processing real time multimedia data for applications ranging from simple voice communications to streaming high definition video. As such, general-purpose information appliances are replacing purpose-built communications devices (e.g., a telephone). For example, smart phones can support telephony communications but they are also capable of text messaging and accessing the Internet to perform functions including email, web browsing, remote applications access, and media communications (e.g., telephony voice, image transfer, music files, video files, real time video streaming. etc.).

Each type of computer is constructed and operates in accordance with one or more communication, processing, and storage standards. As a result of standardization and with advances in technology, more and more information content is being converted into digital formats. For example, more digital cameras are now being sold than film cameras, thus producing more digital pictures. As another example, web-based programming is becoming an alternative to over the air television broadcasts and/or cable broadcasts. As further examples, papers, books, video entertainment, home video, etc. are now being stored digitally, which increases the demand on the storage function of computers.

A typical computer storage system includes one or more memory devices aligned with the needs of the various operational aspects of the computer's processing and communication functions. Generally, the immediacy of access dictates what type of memory device is used. For example, random access memory (RAM) memory can be accessed in any random order with a constant response time, thus it is typically used for cache memory and main memory. By contrast, memory device technologies that require physical movement such as magnetic disks, tapes, and optical discs, have a variable response time as the physical movement can take longer than the data transfer, thus they are typically used for secondary memory (e.g., hard drive, backup memory, etc.).

A computer's storage system will be compliant with one or more computer storage standards that include, but are not limited to, network file system (NFS), flash file system (FFS), disk file system (DFS), small computer system interface (SCSI), internet small computer system interface (iSCSI), file transfer protocol (FTP), and web-based distributed authoring and versioning (WebDAV). These standards specify the data storage format (e.g., files, data objects, data blocks, directories, etc.) and interfacing between the computer's processing function and its storage system, which is a primary function of the computer's memory controller. Data is stored in a memory device in accordance with the data storage format such that any subsequent updates to the data require overwriting the stored data in the memory device. The rewriting of updated data may be costly in terms of utilization of the interfacing between the computer's processing function and the storage system.

Despite the standardization of the computer and its storage system, memory devices fail; especially commercial grade memory devices that utilize technologies incorporating physical movement (e.g., a disc drive). For example, it is fairly common for a disc drive to routinely suffer from bit level corruption and to completely fail after three years of use. One solution is to utilize a higher-grade disc drive, which adds significant cost to a computer.

Another solution is to utilize multiple levels of redundant disc drives to replicate the data into two or more copies. One such redundant drive approach is called redundant array of independent discs (RAID). In a RAID device, a RAID controller adds parity data to the original data before storing it across the array. The parity data is calculated from the original data such that the failure of a disc will not result in the loss of the original data. For example, RAID 5 uses three discs to protect data from the failure of a single disc. The parity data, and associated redundancy overhead data, reduces the storage capacity of three independent discs by one third (e.g., $n-1$=capacity). RAID 6 can recover from a loss of two discs and requires a minimum of four discs with a storage capacity of $n-2$.

While RAID addresses the memory device failure issue, it is not without its own failure issues that affect its effectiveness, efficiency and security. For instance, as more discs are added to the array, the probability of a disc failure increases, which increases the demand for maintenance. For example, when a disc fails, it needs to be manually replaced before another disc fails and the data stored in the RAID device is lost. To reduce the risk of data loss, data on a RAID device is typically copied on to one or more other RAID devices. While this addresses the loss of data issue, it raises a security issue since multiple copies of data are available, which increases the chances of unauthorized access. Further, as the amount of data being stored grows, the overhead of RAID devices becomes a non-trivial efficiency issue.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG. **1** is a schematic block diagram of an embodiment of a computing system in accordance with the present invention;

FIG. **2** is a schematic block diagram of an embodiment of a computing core in accordance with the present invention;

FIG. **3** is a schematic block diagram of an embodiment of a distributed storage processing unit in accordance with the present invention;

FIG. **4** is a schematic block diagram of an embodiment of a grid module in accordance with the present invention;

FIG. **5** is a diagram of an example embodiment of error coded data slice creation in accordance with the present invention;

FIG. **6**A is a schematic block diagram of another embodiment of a computing system in accordance with the present invention;

FIG. **6**B is a diagram illustrating an example of a source name structure in accordance with the present invention;

FIG. **6**C is a diagram illustrating an example of an object number structure in accordance with the present invention;

FIG. **6**D is a schematic block diagram of another embodiment of a computing system in accordance with the present invention;

FIG. **6**E is a flowchart illustrating an example of storing large amounts of data in accordance with the present invention;

FIG. **6**F is a schematic block diagram of another embodiment of a computing system in accordance with the present invention; and

FIG. **6**G is a flowchart illustrating an example of retrieving data objects having a common aspect in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a schematic block diagram of a computing system **10** that includes one or more of a first type of user devices **12**, one or more of a second type of user devices **14**, at least one distributed storage (DS) processing unit **16**, at least one DS managing unit **18**, at least one storage integrity processing unit **20**, and a distributed storage network (DSN) memory **22** coupled via a network **24**. The network **24** may include one or more wireless and/or wire lined communication systems; one or more private intranet systems and/or public internet systems; and/or one or more local area networks (LAN) and/or wide area networks (WAN).

The DSN memory **22** includes a plurality of distributed storage (DS) units **36** for storing data of the system. Each of the DS units **36** includes a processing module and memory and may be located at a geographically different site than the other DS units (e.g., one in Chicago, one in Milwaukee, etc.).

Each of the user devices **12**-**14**, the DS processing unit **16**, the DS managing unit **18**, and the storage integrity processing unit **20** may be a portable computing device (e.g., a social networking device, a gaming device, a cell phone, a smart phone, a personal digital assistant, a digital music player, a digital video player, a laptop computer, a handheld computer, a video game controller, and/or any other portable device that includes a computing core) and/or a fixed computing device (e.g., a personal computer, a computer server, a cable set-top box, a satellite receiver, a television set, a printer, a fax machine, home entertainment equipment, a video game console, and/or any type of home or office computing equipment). Such a portable or fixed computing device includes a computing core **26** and one or more interfaces **30**, **32**, and/or **33**. An embodiment of the computing core **26** will be described with reference to FIG. **2**.

With respect to the interfaces, each of the interfaces **30**, **32**, and **33** includes software and/or hardware to support one or more communication links via the network **24** indirectly and/or directly. For example, interface **30** supports a communication link (wired, wireless, direct, via a LAN, via the network **24**, etc.) between the first type of user device **14** and the DS processing unit **16**. As another example, DSN interface **32** supports a plurality of communication links via the network **24** between the DSN memory **22** and the DS processing unit **16**, the first type of user device **12**, and/or the storage integrity processing unit **20**. As yet another example, interface **33** supports a communication link between the DS managing unit **18** and any one of the other devices and/or units **12**, **14**, **16**, **20**, and/or **22** via the network **24**.

In general and with respect to data storage, the system **10** supports three primary functions: distributed network data storage management, distributed data storage and retrieval, and data storage integrity verification. In accordance with these three primary functions, data can be distributedly stored in a plurality of physically different locations and subsequently retrieved in a reliable and secure manner regardless of failures of individual storage devices, failures of network equipment, the duration of storage, the amount of data being stored, attempts at hacking the data, etc.

The DS managing unit **18** performs distributed network data storage management functions, which include establishing distributed data storage parameters, performing network operations, performing network administration, and/or performing network maintenance. The DS managing unit **18** establishes the distributed data storage parameters (e.g., allocation of virtual DSN memory space, distributed storage parameters, security parameters, billing information, user profile information, etc.) for one or more of the user devices **12**-**14** (e.g., established for individual devices, established for a user group of devices, established for public access by the user devices, etc.). For example, the DS managing unit **18** coordinates the creation of a vault (e.g., a virtual memory block) within the DSN memory **22** for a user device (for a group of devices, or for public access). The DS managing unit **18** also determines the distributed data storage parameters for the vault. In particular, the DS managing unit **18** determines a number of slices (e.g., the number that a data segment of a data file and/or data block is partitioned into for distributed storage) and a read threshold value (e.g., the minimum number of slices required to reconstruct the data segment).

As another example, the DS managing unit **18** creates and stores, locally or within the DSN memory **22**, user profile information. The user profile information includes one or more of authentication information, permissions, and/or the security parameters. The security parameters may include one or more of encryption/decryption scheme, one or more encryption keys, key generation scheme, and data encoding/decoding scheme.

As yet another example, the DS managing unit **18** creates billing information for a particular user, user group, vault access, public vault access, etc. For instance, the DS managing unit **18** tracks the number of times a user accesses a private vault and/or public vaults, which can be used to generate a per-access bill. In another instance, the DS managing unit **18** tracks the amount of data stored and/or retrieved by a user device and/or a user group, which can be used to generate a per-data-amount bill.

The DS managing unit **18** also performs network operations, network administration, and/or network maintenance. As at least part of performing the network operations and/or administration, the DS managing unit **18** monitors performance of the devices and/or units of the system **10** for potential failures, determines the devices' and/or units' activation status, determines the devices' and/or units' loading, and any other system level operation that affects the performance level of the system **10**. For example, the DS managing unit **18** receives and aggregates network management alarms, alerts, errors, status information, performance information, and messages from the devices **12-14** and/or the units **16**, **20**, **22**. For example, the DS managing unit **18** receives a simple network management protocol (SNMP) message regarding the status of the DS processing unit **16**.

The DS managing unit **18** performs the network maintenance by identifying equipment within the system **10** that needs replacing, upgrading, repairing, and/or expanding. For example, the DS managing unit **18** determines that the DSN memory **22** needs more DS units **36** or that one or more of the DS units **36** needs updating.

The second primary function (i.e., distributed data storage and retrieval) begins and ends with a user device **12-14**. For instance, if a second type of user device **14** has a data file **38** and/or data block **40** to store in the DSN memory **22**, it sends the data file **38** and/or data block **40** to the DS processing unit **16** via its interface **30**. As will be described in greater detail with reference to FIG. **2**, the interface **30** functions to mimic a conventional operating system (OS) file system interface (e.g., network file system (NFS), flash file system (FFS), disk file system (DFS), file transfer protocol (FTP), web-based distributed authoring and versioning (WebDAV), etc.) and/or a block memory interface (e.g., small computer system interface (SCSI), internet small computer system interface (iSCSI), etc.). In addition, the interface **30** may attach a user identification code (ID) to the data file **38** and/or data block **40**.

The DS processing unit **16** receives the data file **38** and/or data block **40** via its interface **30** and performs a distributed storage (DS) process **34** thereon (e.g., an error coding dispersal storage function). The DS processing **34** begins by partitioning the data file **38** and/or data block **40** into one or more data segments, which is represented as Y data segments. For example, the DS processing **34** may partition the data file **38** and/or data block **40** into a fixed byte size segment (e.g., 2^1 to 2^n bytes, where n=>2) or a variable byte size (e.g., change byte size from segment to segment, or from groups of segments to groups of segments, etc.).

For each of the Y data segments, the DS processing **34** error encodes (e.g., forward error correction (FEC), information dispersal algorithm, or error correction coding) and slices (or slices then error encodes) the data segment into a plurality of error coded (EC) data slices **42-48**, which is represented as X slices per data segment. The number of slices (X) per segment, which corresponds to a number of pillars n, is set in accordance with the distributed data storage parameters and the error coding scheme. For example, if a Reed-Solomon (or other FEC scheme) is used in an n/k system, then a data segment is divided into n slices, where k number of slices is needed to reconstruct the original data (i.e., k is the threshold). As a few specific examples, the n/k factor may be 5/3; 6/4; 8/6; 8/5; 16/10.

For each EC slice **42-48**, the DS processing unit **16** creates a unique slice name and appends it to the corresponding slice **42-48**. The slice name includes universal DSN memory addressing routing information (e.g., virtual memory addresses in the DSN memory **22**) and user-specific information (e.g., user ID, file name, data block identifier, etc.).

The DS processing unit **16** transmits the plurality of EC slices **42-48** to a plurality of DS units **36** of the DSN memory **22** via the DSN interface **32** and the network **24**. The DSN interface **32** formats each of the slices for transmission via the network **24**. For example, the DSN interface **32** may utilize an internet protocol (e.g., TCP/IP, etc.) to packetize the EC slices **42-48** for transmission via the network **24**.

The number of DS units **36** receiving the EC slices **42-48** is dependent on the distributed data storage parameters established by the DS managing unit **18**. For example, the DS managing unit **18** may indicate that each slice is to be stored in a different DS unit **36**. As another example, the DS managing unit **18** may indicate that like slice numbers of different data segments are to be stored in the same DS unit **36**. For example, the first slice of each of the data segments is to be stored in a first DS unit **36**, the second slice of each of the data segments is to be stored in a second DS unit **36**, etc. In this manner, the data is encoded and distributedly stored at physically diverse locations to improve data storage integrity and security.

Each DS unit **36** that receives an EC slice **42-48** for storage translates the virtual DSN memory address of the slice into a local physical address for storage. Accordingly, each DS unit **36** maintains a virtual to physical memory mapping to assist in the storage and retrieval of data.

The first type of user device **12** performs a similar function to store data in the DSN memory **22** with the exception that it includes the DS processing. As such, the device **12** encodes and slices the data file and/or data block it has to store. The device then transmits the slices **11** to the DSN memory via its DSN interface **32** and the network **24**.

For a second type of user device **14** to retrieve a data file or data block from memory, it issues a read command via its interface **30** to the DS processing unit **16**. The DS processing unit **16** performs the DS processing **34** to identify the DS units **36** storing the slices of the data file and/or data block based on the read command. The DS processing unit **16** may also communicate with the DS managing unit **18** to verify that the user device **14** is authorized to access the requested data.

Assuming that the user device is authorized to access the requested data, the DS processing unit **16** issues slice read commands to at least a threshold number of the DS units **36** storing the requested data (e.g., to at least 10 DS units for a 16/10 error coding scheme). Each of the DS units **36** receiving the slice read command, verifies the command, accesses its virtual to physical memory mapping, retrieves the requested slice, or slices, and transmits it to the DS processing unit **16**.

Once the DS processing unit **16** has received a read threshold number of slices for a data segment, it performs an error decoding function and de-slicing to reconstruct the data segment. When Y number of data segments has been reconstructed, the DS processing unit **16** provides the data file **38** and/or data block **40** to the user device **14**. Note that the first type of user device **12** performs a similar process to retrieve a data file and/or data block.

The storage integrity processing unit **20** performs the third primary function of data storage integrity verification. In general, the storage integrity processing unit **20** periodically retrieves slices **45**, and/or slice names, of a data file or data block of a user device to verify that one or more slices have not been corrupted or lost (e.g., the DS unit failed). The retrieval process mimics the read process previously described.

If the storage integrity processing unit **20** determines that one or more slices is corrupted or lost, it rebuilds the corrupted or lost slice(s) in accordance with the error coding scheme. The storage integrity processing unit **20** stores the rebuilt slice, or slices, in the appropriate DS unit(s) **36** in a manner that mimics the write process previously described.

FIG. **2** is a schematic block diagram of an embodiment of a computing core **26** that includes a processing module **50**, a memory controller **52**, main memory **54**, a video graphics processing unit **55**, an input/output (IO) controller **56**, a peripheral component interconnect (PCI) interface **58**, an IO interface **60**, at least one IO device interface module **62**, a read only memory (ROM) basic input output system (BIOS) **64**, and one or more memory interface modules. The memory interface module(s) includes one or more of a universal serial bus (USB) interface module **66**, a host bus adapter (HBA) interface module **68**, a network interface module **70**, a flash interface module **72**, a hard drive interface module **74**, and a DSN interface module **76**. Note the DSN interface module **76** and/or the network interface module **70** may function as the interface **30** of the user device **14** of FIG. **1**. Further note that the IO device interface module **62** and/or the memory interface modules may be collectively or individually referred to as IO ports.

FIG. **3** is a schematic block diagram of an embodiment of a dispersed storage (DS) processing module **34** of user device **12** and/or of the DS processing unit **16**. The DS processing module **34** includes a gateway module **78**, an access module **80**, a grid module **82**, and a storage module **84**. The DS processing module **34** may also include an interface **30** and the DSnet interface **32** or the interfaces **68** and/or **70** may be part of user device **12** or of the DS processing unit **16**. The DS processing module **34** may further include a bypass/feedback path between the storage module **84** to the gateway module **78**. Note that the modules **78**-**84** of the DS processing module **34** may be in a single unit or distributed across multiple units.

In an example of storing data, the gateway module **78** receives an incoming data object that includes a user ID field **86**, an object name field **88**, and the data object field **40** and may also receive corresponding information that includes a process identifier (e.g., an internal process/application ID), metadata, a file system directory, a block number, a transaction message, a user device identity (ID), a data object identifier, a source name, and/or user information. The gateway module **78** authenticates the user associated with the data object by verifying the user ID **86** with the managing unit **18** and/or another authenticating unit.

When the user is authenticated, the gateway module **78** obtains user information from the management unit **18**, the user device, and/or the other authenticating unit. The user information includes a vault identifier, operational parameters, and user attributes (e.g., user data, billing information, etc.). A vault identifier identifies a vault, which is a virtual memory space that maps to a set of DS storage units **36**. For example, vault **1** (i.e., user **1**'s DSN memory space) includes eight DS storage units (X=8 wide) and vault **2** (i.e., user **2**'s DSN memory space) includes sixteen DS storage units (X=16 wide). The operational parameters may include an error coding algorithm, the width n (number of pillars X or slices per segment for this vault), a read threshold T, a write threshold, an encryption algorithm, a slicing parameter, a compression algorithm, an integrity check method, caching settings, parallelism settings, and/or other parameters that may be used to access the DSN memory layer.

The gateway module **78** uses the user information to assign a source name **35** to the data. For instance, the gateway module **78** determines the source name **35** of the data object **40** based on the vault identifier and the data object. For example, the source name may contain a file identifier (ID), a vault generation number, a reserved field, and a vault identifier (ID). As another example, the gateway module **78** may generate the file ID based on a hash function of the data object **40**. Note that the gateway module **78** may also perform message conversion, protocol conversion, electrical conversion, optical conversion, access control, user identification, user information retrieval, traffic monitoring, statistics generation, configuration, management, and/or source name determination.

The access module **80** receives the data object **40** and creates a series of data segments **1** through Y **90**-**92** in accordance with a data storage protocol (e.g., file storage system, a block storage system, and/or an aggregated block storage system). The number of segments Y may be chosen or randomly assigned based on a selected segment size and the size of the data object. For example, if the number of segments is chosen to be a fixed number, then the size of the segments varies as a function of the size of the data object. For instance, if the data object is an image file of 4,194,304 eight bit bytes (e.g., 33,554,432 bits) and the number of segments Y=131,072, then each segment is 256 bits or 32 bytes. As another example, if segment size is fixed, then the number of segments Y varies based on the size of data object. For instance, if the data object is an image file of 4,194,304 bytes and the fixed size of each segment is 4,096 bytes, then the number of segments Y=1,024. Note that each segment is associated with the same source name.

The grid module **82** receives the data segments and may manipulate (e.g., compression, encryption, cyclic redundancy check (CRC), etc.) each of the data segments before performing an error coding function of the error coding dispersal storage function to produce a pre-manipulated data segment. After manipulating a data segment, if applicable, the grid module **82** error encodes (e.g., Reed-Solomon, Convolution encoding, Trellis encoding, etc.) the data segment or manipulated data segment into X error coded data slices **42**-**48**.

The value X, or the number of pillars (e.g., X=16), is chosen as a parameter of the error coding dispersal storage function. Other parameters of the error coding dispersal function include a read threshold T, a write threshold W, etc. The read threshold (e.g., T=10, when X=16) corresponds to the minimum number of error-free error coded data slices required to reconstruct the data segment. In other words, the DS processing module **34** can compensate for X-T (e.g., 16−10=6) missing error coded data slices per data segment. The write threshold W corresponds to a minimum number of DS storage units that acknowledge proper storage of their respective data slices before the DS processing module indicates proper storage of the encoded data segment. Note that the write threshold is greater than or equal to the read threshold for a given number of pillars (X).

For each data slice of a data segment, the grid module **82** generates a unique slice name **37** and attaches it thereto. The slice name **37** includes a universal routing information field and a vault specific field and may be 48 bytes (e.g., 24 bytes for each of the universal routing information field and the vault specific field). As illustrated, the universal routing information field includes a slice index, a vault ID, a vault generation, and a reserved field. The slice index is based on the pillar number and the vault ID and, as such, is unique for each pillar (e.g., slices of the same pillar for the same vault for any segment will share the same slice index). The vault specific field includes a data name, which includes a file ID and a segment number (e.g., a sequential numbering of data segments **1**-Y of a simple data object or a data block number).

Prior to outputting the error coded data slices of a data segment, the grid module may perform post-slice manipulation on the slices. If enabled, the manipulation includes slice level compression, encryption, CRC, addressing, tagging, and/or other manipulation to improve the effectiveness of the computing system.

When the error coded data slices of a data segment are ready to be outputted, the grid module **82** determines which of the DS storage units **36** will store the EC data slices based on a dispersed storage memory mapping associated with the user's vault and/or DS storage unit attributes. The DS storage unit attributes may include availability, self-selection, performance history, link speed, link latency, ownership, available DSN memory, domain, cost, a prioritization scheme, a centralized selection message from another source, a lookup table, data ownership, and/or any other factor to optimize the operation of the computing system. Note that the number of DS storage units **36** is equal to or greater than the number of pillars (e.g., X) so that no more than one error coded data slice of the same data segment is stored on the same DS storage unit **36**. Further note that EC data slices of the same pillar number but of different segments (e.g., EC data slice **1** of data segment **1** and EC data slice **1** of data segment **2**) may be stored on the same or different DS storage units **36**.

The storage module **84** performs an integrity check on the outbound encoded data slices and, when successful, identifies a plurality of DS storage units based on information provided by the grid module **82**. The storage module **84** then outputs the encoded data slices **1** through X of each segment **1** through Y to the DS storage units **36**. Each of the DS storage units **36** stores its EC data slice(s) and maintains a local virtual DSN address to physical location table to convert the virtual DSN address of the EC data slice(s) into physical storage addresses.

In an example of a read operation, the user device **12** and/or **14** sends a read request to the DS processing unit **16**, which authenticates the request. When the request is authentic, the DS processing unit **16** sends a read message to each of the DS storage units **36** storing slices of the data object being read. The slices are received via the DSnet interface **32** and processed by the storage module **84**, which performs a parity check and provides the slices to the grid module **82** when the parity check was successful. The grid module **82** decodes the slices in accordance with the error coding dispersal storage function to reconstruct the data segment. The access module **80** reconstructs the data object from the data segments and the gateway module **78** formats the data object for transmission to the user device.

FIG. **4** is a schematic block diagram of an embodiment of a grid module **82** that includes a control unit **73**, a pre-slice manipulator **75**, an encoder **77**, a slicer **79**, a post-slice manipulator **81**, a pre-slice de-manipulator **83**, a decoder **85**, a de-slicer **87**, and/or a post-slice de-manipulator **89**. Note that the control unit **73** may be partially or completely external to the grid module **82**. For example, the control unit **73** may be part of the computing core at a remote location, part of a user device, part of the DS managing unit **18**, or distributed amongst one or more DS storage units.

In an example of write operation, the pre-slice manipulator **75** receives a data segment **90-92** and a write instruction from an authorized user device. The pre-slice manipulator **75** determines if pre-manipulation of the data segment **90-92** is required and, if so, what type. The pre-slice manipulator **75** may make the determination independently or based on instructions from the control unit **73**, where the determination is based on a computing system-wide predetermination, a table lookup, vault parameters associated with the user identification, the type of data, security requirements, available DSN memory, performance requirements, and/or other metadata.

Once a positive determination is made, the pre-slice manipulator **75** manipulates the data segment **90-92** in accordance with the type of manipulation. For example, the type of manipulation may be compression (e.g., Lempel-Ziv-Welch, Huffman, Golomb, fractal, wavelet, etc.), signatures (e.g., Digital Signature Algorithm (DSA), Elliptic Curve DSA, Secure Hash Algorithm, etc.), watermarking, tagging, encryption (e.g., Data Encryption Standard, Advanced Encryption Standard, etc.), adding metadata (e.g., time/date stamping, user information, file type, etc.), cyclic redundancy check (e.g., CRC32), and/or other data manipulations to produce the pre-manipulated data segment.

The encoder **77** encodes the pre-manipulated data segment **92** using a forward error correction (FEC) encoder (and/or other type of erasure coding and/or error coding) to produce an encoded data segment **94**. The encoder **77** determines which forward error correction algorithm to use based on a predetermination associated with the user's vault, a time based algorithm, user direction, DS managing unit direction, control unit direction, as a function of the data type, as a function of the data segment **90-92** metadata, and/or any other factor to determine algorithm type. The forward error correction algorithm may be Golay, Multidimensional parity, Reed-Solomon, Hamming, Bose Ray Chauduri Hocquenghem (BCH), Cauchy-Reed-Solomon, or any other FEC encoder. Note that the encoder **77** may use a different encoding algorithm for each data segment **90-92**, the same encoding algorithm for the data segments **90-92** of a data object, or a combination thereof.

The encoded data segment **94** is of greater size than the data segment **90-92** by the overhead rate of the encoding algorithm by a factor of X/T, where X is the width or number of slices, and T is the read threshold. In this regard, the corresponding decoding process can accommodate at most X-T missing EC data slices and still recreate the data segment **90-92**. For example, if X=16 and T=10, then the data segment **90-92** will be recoverable as long as 10 or more EC data slices per segment are not corrupted.

The slicer **79** transforms the encoded data segment **94** into EC data slices in accordance with the slicing parameter from the vault for this user and/or data segment **90-92**. For example, if the slicing parameter is X=16, then the slicer **79** slices each encoded data segment **94** into 16 encoded slices.

The post-slice manipulator **81** performs, if enabled, post-manipulation on the encoded slices to produce the EC data slices. If enabled, the post-slice manipulator **81** determines the type of post-manipulation, which may be based on a computing system-wide predetermination, parameters in the vault for this user, a table lookup, the user identification, the type of data, security requirements, available DSN memory, performance requirements, control unit directed, and/or other metadata. Note that the type of post-slice manipulation may include slice level compression, signatures, encryption, CRC, addressing, watermarking, tagging, adding metadata, and/or other manipulation to improve the effectiveness of the computing system.

In an example of a read operation, the post-slice de-manipulator **89** receives at least a read threshold number of EC data slices and performs the inverse function of the post-slice manipulator **81** to produce a plurality of encoded slices. The de-slicer **87** de-slices the encoded slices to produce an encoded data segment **94**. The decoder **85** performs the inverse function of the encoder **77** to recapture the data segment **90-92**. The pre-slice de-manipulator **83** performs the inverse function of the pre-slice manipulator **75** to recapture the data segment **90-92**.

FIG. **5** is a diagram of an example of slicing an encoded data segment **94** by the slicer **79**. In this example, the encoded data segment **94** includes thirty-two bits, bytes, data words, etc., but may include more or less bits, bytes, data words, etc. The slicer **79** disperses the bits of the encoded data segment **94** across the EC data slices in a pattern as shown. As such, each EC data slice does not include consecutive bits, bytes, data words, etc. of the data segment **94** reducing the impact of consecutive bit, byte, data word, etc. failures on data recovery. For example, if EC data slice **2** (which includes bits **1**, **5**, **9**, **13**, **17**, **25**, and **29**) is unavailable (e.g., lost, inaccessible, or corrupted), the data segment can be reconstructed from the other EC data slices (e.g., 1, 3 and 4 for a read threshold of 3 and a width of 4).

FIG. **6**A is a schematic block diagram of another embodiment of a computing system that includes communication networks **102**, a plurality of capturing units **104**, a dispersed storage network (DSN) memory **22**, a common data aspect database **106**, and a plurality of retrieving units **108**. The communication network **102** includes one or more of a wireless communication network, a wireline communication network (public switched telephone network), an Internet, a computing network, a data storage network, and a sensor network. A capturing unit **104** of the plurality of capturing units **104** may be implemented utilizing at least one of a dispersed storage (DS) processing unit, a user device, a DS unit, and a data ingestion processing module. The DSN memory **22** includes a plurality of DS units and may include the common data aspect database **106**. The common data aspect database **106** may be implemented utilizing at least one of a database application, a database server, and one or more DS units of the plurality of DS units.

The system is operable to capture millions of data objects **110** from the communication networks **102**, encode the data objects **110** to produce slices **114**, store the slices **114** in the DSN memory **22** in accordance with aspects **188**, storing records **112** of the storing in the common data aspect database **106**, retrieve the slices **114** from the DSN memory **22** in accordance with the aspects **188**, and decode the slices **114** to recover one or more data objects **110**. The storing and retrieving of the slices **114** includes generating DSN addresses **116** based on the aspects **118** and utilizing the DSN addresses **116** to access the DSN memory **22**. The DSN addresses **116** include at least one of a slice name, a vault source name, and a source name. Structure of the DSN addresses is discussed in greater detail with reference to FIGS. **6**B-C. Methods and apparatus to utilize the aspects **118** to generate the DSN addresses **116** is discussed in greater detail with reference to FIGS. **6**E-**6**G.

FIG. **6**B is a diagram illustrating an example of a slice name structure **120** that includes a slice index field **122** and a vault source name field **124**. The slice index field **122** includes one or more slice index entries corresponding to a pillar number. The vault source name field **124** includes a source name field **126** and a segment number field **128**. The segment number field **128** includes at least one segment number entry corresponding to a segment number of a data object being stored. The source name field **126** includes a vault identifier (ID) field **130**, a vault generation field **132**, and an object number field **134**. A segment number entry identifies a segment corresponding to a common source name entry. For example, sequential segment number entries 1-10 corresponds to a given source name entry for storage of a data object that requires 10 segments. The vault ID field **130** includes one or more vault ID entries corresponding to the data object being stored. The vault generation field **132** includes one or more vault generation entries corresponding to a generation of each vault being stored. The object number field **134** includes one or more object number entries, wherein an object number entry is associated with a data object being stored.

An object number entry may be generated as at least one of the random number, a sequential number, a predetermined number, and an aspect driven number. For example, an object number entry for a first data object includes two aspects including a first aspect that is shared in common with a second data object and a second aspect that is unique to the first data object. An object number entry for the second data object includes the first aspect that is shared in common with the first data object and a second aspect that is unique to the second data object. Alternatively, a source name entry may be generated as an aspect driven number. A structure for entries of the source name field **126** and the object number field **134** is discussed in greater detail with reference to FIG. **6**C.

FIG. **6**C is a diagram illustrating an example of a structure of a source name field **126** or an object number field **134** that includes at least to the aspect driven fields including a data object aspect field **136** and a data object identifier (ID) field **138**. Alternatively, the structure of the source name field **126** or object number field **134** may include more than two aspect driven fields. The overall structure includes a plurality of entries. Each entry of the plurality of entries includes a data object aspect value for the data object aspect field **136** and a corresponding data object ID value of the data object ID field **138**. Each data object aspect value includes at least one of a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object (e.g., names, key words and/or phrases, etc.), data size of the data object, a data object type (e.g., video, text, bank transaction, etc.), a capturing unit ID that obtained the data object, a collection identifier (ID), a random number, and a vault ID (includes generation and/or group affiliation). For example, a series of different data objects written to a dispersed storage network (DSN) memory within a common time period of Jul. 16, 2012 from 7:00 AM to 8:00 AM share a common data object aspect field entry.

The data object ID field **138** includes one or more corresponding data object ID entries. A data object ID entry includes a unique value per data object utilizing a common data object aspect field entry. Each data object ID may be based on one or more of a random number, a previous data object ID incremented by 1 or more, a previous data object ID decremented by 1 or more, and a result of a deterministic function (e.g., a hashing function) performed on a data name of the data object. Each data object of a plurality of data objects may be assigned a different data object ID when the plurality of data objects share a common aspect is represented by a common data object aspect field entry. For example, a first data object is assigned a data object ID field entry of 1 and a second data object is assigned a data object ID field entry of 2 when the first and second data objects share in the common data object aspect field entry of Jul. 16, 2012 from 8:00 AM to 9:00 AM. The source name field **126** or object number **134** may be utilized by a dispersed storage (DS) unit to select a memory device of a plurality of memory devices associated with the DS unit for storage of an associated encoded data slice. For example, the data object aspect field entry is utilized to select a memory device and the data object ID field entry is utilized to select an offset within the memory device. The method and apparatus of generation of the source name field entry or object number field entry is discussed in greater detail with reference to FIGS. 6D-6G.

FIG. 6D is a schematic block diagram of another embodiment of a computing system that includes a computing device 140, communication networks 102, and a dispersed storage network (DSN) memory 22. The computing device 140 may be implemented as one or more of a capturing unit, user device, a dispersed storage processing (DS) unit, a DS unit, a DS managing unit, and a storage integrity processing unit. The computing device 140 includes a DS module 142 and may include a common data aspect database 106. Alternatively, the common data aspect database 106 is implemented within the DSN memory 22. The DS module 142 includes an ingest module 144, an aspect module 146, an encode module 148, an address module 150, an output module 152, a records module 154, and a decode module 156. The system is operable to ingest a plurality of data objects 158 from the communication networks 102 and facilitate storage of the plurality of data objects 158 in the DSN memory 22. The facilitating storage includes determining one or more common data object aspects 160 of each data object 158, encoding a data object to produce a set of encoded data slices 162, generating a set of DSN addresses 164 referencing the one or more common data object aspects 160, outputting the set of encoded data slices 162 for storage in the DSN memory 22, and creating a record 166 for the data object 158 in the common data object aspect database 106.

The ingest module 144 obtains a plurality of data objects for storage in the DSN memory 22. The obtaining includes receiving, for each data object of the plurality of data objects, one or more of the data object, a data name associated with the data object, a data object identifier (ID) associated with the data object, and a common data object aspect. The aspect module 146 determines one or more common data object aspects 160 of a data object of the plurality of data objects 158. A common data object aspect of the one or more common data object aspects 160 is an aspect shared by two or more of the plurality of data objects 158. The common data object aspect is one of a plurality of common data object aspects that includes two or more of: a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object (e.g., names, key words and/or phrases, etc.), data size of the data object, a data object type (e.g., video, text, bank transaction, etc.), a capturing unit ID that obtained the data object, and a vault ID (e.g., includes generation and/or group affiliation). The determining of the one or more common data object aspects 160 may be based on one or more of receiving at least one common data object aspect with a corresponding data object, a query to a communication network of the communication networks 102, an analysis, and a lookup based on the data name.

The encode module 148 disperse storage error encodes at least a portion of the data object to produce a set of encoded data slices 162. A portion may include one or more data segments. The address module 150 generates a set of DSN addresses 164 for the set of encoded data slices 162. Each of the set of DSN addresses includes a field referencing the one or more common data object aspects 160. The address module 150 generates a DSN address of the set of DSN addresses by generating a slice index field, generating a data object aspect field, generating a data object ID, and generating a segment field regarding the at least a portion of the data object. The output module 152 outputs the set of encoded data slices 162 for storage in the DSN memory 22 based on the set of DSN addresses 164. For example, the output module 152 generates a set of write slice requests that includes a set of slice names of the set of DSN addresses 164 and the set of encoded data slices 162. Next the output module 152 sends the set of write slice requests to the DSN memory 22.

The records module 154 creates a record 166 for the data object in the common data object aspect database 106. The record 166 may include one or more of a data object identifier, information regarding the one or more common data object aspects (e.g., how many, which aspects), and a portions number indicating a number of portions constituting the data object. The common data object aspect database includes a plurality of records for at least some of the plurality of data objects 158.

The system is further operable to store a plurality of portions of each data object of the plurality of data objects 158. When storing the plurality of portions of each data object, the encode module 148 divides the data object into a plurality of portions and disperse storage error encode the plurality of portions to produce a plurality of sets of encoded data slices 162. The address module 150 generates a plurality of sets of DSN addresses 164 for the plurality of sets of encoded data slices 162. Each DSN address of the plurality of sets of DSN addresses 164 includes a field referencing the one or more common data object aspects 160. The output module 152 outputs the plurality of sets of encoded data slices 162 for storage in the DSN memory 22 based on the plurality of sets of DSN addresses 164.

The system is further operable to refresh storage of the data object utilizing additional common data object aspects 160. The refreshing includes the decode module 156 decoding a decode threshold number of the set of encoded data slices 162 for each portion of the data object to produce a reconstructed data object 168. The aspect module 146 analyzes the reconstructed data object 168 to identify additional common data object aspects. The encode module 148 disperse storage error encode at least a portion of the reconstructed data object 168 to produce a new set of encoded data slices 162. The address module 150 generates a new set of DSN addresses 164 for the new set of encoded data slices 162. Each of the new set of DSN addresses 164 includes a field referencing the one or more common data object aspects 160 and the additional common data object aspects. The output module 152 outputs the new set of encoded data slices 162 for storage in the DSN memory 22 based on the new set of DSN addresses 164.

FIG. 6E is a flowchart illustrating an example of storing large amounts of data. The method begins at step 170 where a processing module (e.g., of a capturing unit) obtains (e.g., receives, intercepts, captures, queries, retrieves, collects, etc.) a plurality of data objects for storage in a dispersed storage network (DSN). For example, processing module obtains millions of data objects in a given time period from millions of data object sources. The method continues at step 172 where the processing module determines one or more common data object aspects of a data object of the plurality of data objects. A common data object aspect of the one or more common data object aspects is an aspect shared by two or more of the plurality of data objects. The method continues at step 174 where the processing module disperse storage error encodes at least a portion of the data object (e.g., a data segment) to produce a set of encoded data slices.

The method continues at step 176 where the processing module generates a set of DSN addresses for the set of encoded data slices. Each of the set of DSN addresses includes a field referencing the one or more common data object aspects. The generating a DSN address of the set of

DSN addresses includes generating a slice index field, generating a data object aspect field, generating a data object ID, and generating a segment field regarding the at least a portion of the data object. For example, the processing module generates the data object aspect field to include a common data object aspect of the data object and a previously stored associated data object. As another example, the processing module generates the data object ID to include a data object ID of the previously stored associated data object incremented by one when the data object is a next data object one sequentially storing a sequence of associated data objects.

The method continues at step **178** where the processing module outputs the set of encoded data slices for storage in the DSN based on the set of DSN addresses. Alternatively, or in addition to, the processing module may store more than the at least a portion of the data object. When the processing module stores more than the at least a portion of the data object, the processing module divides the data object into a plurality of portions and disperse storage error encoding the plurality of portions to produce a plurality of sets of encoded data slices. Next, the processing module generates a plurality of sets of DSN addresses for the plurality of sets of encoded data slices. Each DSN address of the plurality of sets of DSN addresses includes a field referencing the one or more common data object aspects. Next, the processing module outputs the plurality of sets of encoded data slices for storage in the DSN based on the plurality of sets of DSN addresses.

The method continues at step **180** where the processing module creates a record for the data object in a common data object aspect database. The record includes a data object identifier, information (e.g., an aspect identifier, aspect details, and aspect name, a cross reference to another data object) regarding the one or more common data object aspects, and a portions number indicating a number of portions constituting the data object. The common data object aspect database includes a plurality of records for at least some of the plurality of data objects.

The method continues at step **182** where the processing module decodes a decode threshold number of the set of encoded data slices for each portion of the data object to produce a reconstructed data object. The method continues at step **184** where the processing module analyzes the reconstructed data object to identify additional common data object aspects. The method continues at step **186** for the processing module disperse storage error encodes at least a portion of the reconstructed data object to produce a new set of encoded data slices. The method continues at step **188** where the processing module generates a new set of DSN addresses for the new set of encoded data slices. Each of the new set of DSN addresses includes a field referencing the one or more common data object aspects and the additional common data object aspects. The method continues at step **190** where the processing module outputs the new set of encoded data slices for storage in the DSN based on the new set of DSN addresses.

FIG. **6F** is a schematic block diagram of another embodiment of a computing system that includes a computing device **200** and a dispersed storage network (DSN) memory **22**. The computing device **200** may be implemented as one or more of a retrieving unit, a user device, a dispersed storage processing (DS) unit, a DS unit, a DS managing unit, and a storage integrity processing unit. The computing device **200** includes a DS module **202** and may include a common data aspect database **106**. Alternatively, the common data aspect database **106** is implemented within the DSN memory **22**. The DS module **202** includes a select aspects module **204**, an aspect database module **206**, a generate DSN address module **208**, a retrieve slices module **210**, and a decode module **212**. The system is operable to facilitate retrieval of one or more data objects **214** from the DSN memory **22**. When retrieving one data object **214** from the DSN memory **22**, the facilitating retrieval includes selecting one or more common data object aspects **216**, accessing the common data aspect database **106** based on the selected common data object aspects **216** to identify a set of records **218**, generating a set of DSN addresses **220**, retrieving at least a decode threshold number of encoded data slices **222** from the DSN based on the set of DSN addresses **220**, and decoding the least a decode threshold number of encoded data slices **222** to reproduce at least a portion of a first data object **214**.

The select aspects module **204** selects one or more common data object aspects from a plurality of common data object aspects to produce selected common data object aspects **216**. The plurality of common data object aspects includes two or more of: a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object (e.g., names, key words and/or phrases, etc.), data size of the data object, a data object type (e.g., video, text, bank transaction, etc.), a capturing unit ID that obtained the data object, and a vault ID (e.g., includes generation and/or group affiliation). The selecting includes at least one of receiving a user input, receiving a request, a lookup, receiving a search parameter, and utilizing a previously selected data object aspects.

The aspect database module **206** accesses the common data object aspect database **106** based on the selected common data object aspects **216** to identify the set of records **218**. A record of the common data object aspect database **106** includes a data object identifier of a data object, information regarding one or more common data object aspects of the data object, and a portions number indicating a number of portions constituting the data object. For example, the aspect database module **206** searches the common data object aspect database **106** to identify a record associated with data object aspects that compare favorably (e.g., substantially aligned) to the selected common data object aspects **216** to produce the set of records **218**.

The generate DSN address module **208** generates the set of DSN addresses **220** based on one or more of the data object identifier, the information regarding the one or more common data object aspects **216**, and the portions number of a first record of the set of records **218**. The generate DSN address module **208** generates a DSN address of the set of DSN addresses **220** by generating a slice index field based on the dispersed storage error encoding function, generating a data object aspect field based on the selected common data object aspects, generating a data object ID based on the data object identifier, and generating a segment field based on the portions number. The retrieve slices module **210** retrieves the at least a decode threshold number of encoded data slices **222** from the DSN memory **22** based on the set of DSN addresses **220**. For example, the retrieve slices module **200** and generates at least a decode threshold number of read slice requests that includes the set of DSN addresses **220**, sends the at least a decode threshold number of read slice requests to the DSN memory **22**, and receives the least a decode threshold number of encoded data slices **222**. The decode module **212** decodes the least a decode threshold number of encoded data slices **222** in accordance with a dispersed storage error encoding function to reproduce at least a portion of the first data object **214**.

The system may retrieve more than the least a portion of the first data object. When the system retrieves more than the at least a portion of the first data object, the generate DSN address module **208** generates a plurality of sets of DSN addresses based on the data object identifier, the information regarding the one or more common data object aspects, and the portions number. For example, the generate DSN address module **208** generates the plurality of sets of DSN addresses to include a plurality of segment numbers in accordance with the portions number (e.g., all segment numbers). Next, the retrieve slices module **210** retrieves at least a decode threshold number of encoded data slices from the DSN memory **22** for each of the plurality of sets of DSN addresses. Next, the decode module **212** decodes the least a decode threshold number of encoded data slices from the DSN for each of the plurality of sets of DSN addresses in accordance with the dispersed storage error encoding function to reproduce a plurality of portions (e.g., all data segments) of the first data object. The decode module **212** reproduces the first data object from the plurality of portions of the first data object. For example, the decode module **212** aggregates the plurality of portions of the first data object to reproduce the first data object.

The system may retrieve more than one data object. When the system retrieves more than one data object, the generate DSN address module **208** generates a second set of DSN addresses based on the data object identifier, the information regarding the one or more common data object aspects, and the portions number of a second record of the set of records. For example, the generate DSN address module **208** increments the value of the data object identifier to produce a second data object identifier utilized in generating the second set of DSN addresses. Next, the retrieve slices module **210** retrieves at least a decode threshold number of second encoded data slices from the DSN memory **22** based on the second set of DSN addresses. The decode module **212** decodes the least a decode threshold number of second encoded data slices in accordance with the dispersed storage error encoding function to reproduce at least a portion of a second data object.

FIG. **6**G is a flowchart illustrating an example of retrieving data objects having a common aspect. The method begins at step **230** where a processing module (e.g., of a retrieving unit) selects one or more common data object aspects from a plurality of common data object aspects to produce selected common data object aspects. The method continues at step **232** where the processing module accesses a common data object aspect database based on the selected common data object aspects to identify a set of records. A record of the common data object aspect database includes a data object identifier of a data object, information regarding one or more common data object aspects of the data object, and a portions number indicating a number of portions constituting the data object.

The method continues at step **234** where the processing module generates a set of dispersed storage network (DSN) addresses based on the data object identifier, the information regarding the one or more common data object aspects, and the portions number of a first record of the set of records. The generating a DSN address of the set of DSN addresses includes generating a slice index field based on the dispersed storage error encoding function, generating a data object aspect field based on the selected common data object aspects, generating a data object ID based on the data object identifier, and generating a segment field based on the portions number. The method continues at step **236** where the processing module retrieves at least a decode threshold number of encoded data slices from the DSN based on the set of DSN addresses. The method continues at step **238** where the processing module decodes the least a decode threshold number of encoded data slices in accordance with a dispersed storage error encoding function to reproduce at least a portion of a first data object.

The processing module may function to retrieve all portions of the first data object. When retrieving all portions, the method continues at step **240** where the processing module generates a plurality of sets of DSN addresses based on the data object identifier, the information regarding the one or more common data object aspects, and the portions number (e.g., for all data segments). The method continues at step **242** where the processing module retrieves at least a decode threshold number of encoded data slices from the DSN for each of the plurality of sets of DSN addresses. The method continues at step **244** where the processing module decodes the at least a decode threshold number of encoded data slices from the DSN for each of the plurality of sets of DSN addresses in accordance with the dispersed storage error encoding function to reproduce a plurality of portions of the first data object. The method continues at step **246** where the processing module reproduces the first data object from the plurality of portions of the first data object.

The processing module may function to retrieve a portion of more than one data object. When retrieving the portion of more than one data object, the method continues at step **248** where the processing module generates a second set of DSN addresses based on the data object identifier (e.g., incrementing a previous data object identifier by one), the information regarding the one or more common data object aspects, and the portions number of a second record of the set of records. The method continues at step **250** where the processing module retrieves at least a decode threshold number of second encoded data slices from the DSN based on the second set of DSN addresses. The method continues at step **252** where the processing module decodes the least a decode threshold number of second encoded data slices in accordance with the dispersed storage error encoding function to reproduce at least a portion of a second data object.

As may be used herein, the terms "substantially" and "approximately" provides an industry-accepted tolerance for its corresponding term and/or relativity between items. Such an industry-accepted tolerance ranges from less than one percent to fifty percent and corresponds to, but is not limited to, component values, integrated circuit process variations, temperature variations, rise and fall times, and/or thermal noise. Such relativity between items ranges from a difference of a few percent to magnitude differences. As may also be used herein, the term(s) "operably coupled to", "coupled to", and/or "coupling" includes direct coupling between items and/or indirect coupling between items via an intervening item (e.g., an item includes, but is not limited to, a component, an element, a circuit, and/or a module) where, for indirect coupling, the intervening item does not modify the information of a signal but may adjust its current level, voltage level, and/or power level. As may further be used herein, inferred coupling (i.e., where one element is coupled to another element by inference) includes direct and indirect coupling between two items in the same manner as "coupled to". As may even further be used herein, the term "operable to" or "operably coupled to" indicates that an item includes one or more of power connections, input(s), output(s), etc., to perform, when activated, one or more its corresponding functions and may further include inferred coupling to one or more other items. As may still further be used herein, the term "associated with", includes direct and/or indirect coupling of separate items and/or one item being embedded within another item. As may be used herein, the term "compares favorably", indicates that a comparison between two or more items, signals, etc., provides a desired relationship. For example, when the desired relationship is that signal **1** has a greater magnitude than signal **2**, a favorable comparison may be achieved when the magnitude of signal **1** is greater than that of signal **2** or when the magnitude of signal **2** is less than that of signal **1**.

As may also be used herein, the terms "processing module", "processing circuit", and/or "processing unit" may be a single processing device or a plurality of processing devices. Such a processing device may be a microprocessor, microcontroller, digital signal processor, microcomputer, central processing unit, field programmable gate array, programmable logic device, state machine, logic circuitry, analog circuitry, digital circuitry, and/or any device that manipulates signals (analog and/or digital) based on hard coding of the circuitry and/or operational instructions. The processing module, module, processing circuit, and/or processing unit may be, or further include, memory and/or an integrated memory element, which may be a single memory device, a plurality of memory devices, and/or embedded circuitry of another processing module, module, processing circuit, and/or processing unit. Such a memory device may be a read-only memory, random access memory, volatile memory, non-volatile memory, static memory, dynamic memory, flash memory, cache memory, and/or any device that stores digital information. Note that if the processing module, module, processing circuit, and/or processing unit includes more than one processing device, the processing devices may be centrally located (e.g., directly coupled together via a wired and/or wireless bus structure) or may be distributedly located (e.g., cloud computing via indirect coupling via a local area network and/or a wide area network). Further note that if the processing module, module, processing circuit, and/or processing unit implements one or more of its functions via a state machine, analog circuitry, digital circuitry, and/or logic circuitry, the memory and/or memory element storing the corresponding operational instructions may be embedded within, or external to, the circuitry comprising the state machine, analog circuitry, digital circuitry, and/or logic circuitry. Still further note that, the memory element may store, and the processing module, module, processing circuit, and/or processing unit executes, hard coded and/or operational instructions corresponding to at least some of the steps and/or functions illustrated in one or more of the Figures. Such a memory device or memory element can be included in an article of manufacture.

The present invention has been described above with the aid of method steps illustrating the performance of specified functions and relationships thereof. The boundaries and sequence of these functional building blocks and method steps have been arbitrarily defined herein for convenience of description. Alternate boundaries and sequences can be defined so long as the specified functions and relationships are appropriately performed. Any such alternate boundaries or sequences are thus within the scope and spirit of the claimed invention. Further, the boundaries of these functional building blocks have been arbitrarily defined for convenience of description. Alternate boundaries could be defined as long as the certain significant functions are appropriately performed. Similarly, flow diagram blocks may also have been arbitrarily defined herein to illustrate certain significant functionality. To the extent used, the flow diagram block boundaries and sequence could have been defined otherwise and still perform the certain significant functionality. Such alternate definitions of both functional building blocks and flow diagram blocks and sequences are thus within the scope and spirit of the claimed invention. One of average skill in the art will also recognize that the functional building blocks, and other illustrative blocks, modules and components herein, can be implemented as illustrated or by discrete components, application specific integrated circuits, processors executing appropriate software and the like or any combination thereof.

The present invention may have also been described, at least in part, in terms of one or more embodiments. An embodiment of the present invention is used herein to illustrate the present invention, an aspect thereof, a feature thereof, a concept thereof, and/or an example thereof. A physical embodiment of an apparatus, an article of manufacture, a machine, and/or of a process that embodies the present invention may include one or more of the aspects, features, concepts, examples, etc. described with reference to one or more of the embodiments discussed herein. Further, from figure to figure, the embodiments may incorporate the same or similarly named functions, steps, modules, etc. that may use the same or different reference numbers and, as such, the functions, steps, modules, etc. may be the same or similar functions, steps, modules, etc. or different ones.

While the transistors in the above described figure(s) is/are shown as field effect transistors (FETs), as one of ordinary skill in the art will appreciate, the transistors may be implemented using any type of transistor structure including, but not limited to, bipolar, metal oxide semiconductor field effect transistors (MOSFET), N-well transistors, P-well transistors, enhancement mode, depletion mode, and zero voltage threshold (VT) transistors.

Unless specifically stated to the contra, signals to, from, and/or between elements in a figure of any of the figures presented herein may be analog or digital, continuous time or discrete time, and single-ended or differential. For instance, if a signal path is shown as a single-ended path, it also represents a differential signal path. Similarly, if a signal path is shown as a differential path, it also represents a single-ended signal path. While one or more particular architectures are described herein, other architectures can likewise be implemented that use one or more data buses not expressly shown, direct connectivity between elements, and/or indirect coupling between other elements as recognized by one of average skill in the art.

The term "module" is used in the description of the various embodiments of the present invention. A module includes a processing module, a functional block, hardware, and/or software stored on memory for performing one or more functions as may be described herein. Note that, if the module is implemented via hardware, the hardware may operate independently and/or in conjunction software and/or firmware. As used herein, a module may contain one or more sub-modules, each of which may be one or more modules.

While particular combinations of various functions and features of the present invention have been expressly described herein, other combinations of these features and functions are likewise possible. The present invention is not limited by the particular examples disclosed herein and expressly incorporates these other combinations.

What is claimed is:

1. A method for storing large amounts of data, the method comprises:

obtaining, by a processing module of a computing device, a plurality of data objects for storage in a dispersed storage network (DSN);

determining, by the processing module, that two data objects of the plurality of data objects have one or more common data object aspects wherein each of the two data objects includes a plurality of data segments;

disperse storage error encoding, by the processing module, the plurality of data segments of a first data object of the two data objects to produce a first plurality of sets of encoded data slices, wherein a data segment of the plurality of data segments is dispersed storage error encoded into a set of encoded data slices of the plurality of sets of encoded data slices and wherein a decode threshold number of encoded data slices of the set of encoded data slices in needed to recover the data segment;

generating, by the processing module, a first plurality of sets of DSN addresses for the first plurality of sets of encoded data slices, wherein DSN addresses of the first plurality of sets of DSN addresses includes a field referencing the one or more common data object aspects;

disperse storage error encoding, by the processing module, the plurality of data segments of a second data object of the two data objects to produce a second plurality of sets of encoded data slices;

generating, by the processing module, a second plurality of sets of DSN addresses for the second plurality of sets of encoded data slices, wherein DSN addresses of the second plurality of sets of DSN addresses includes the field referencing the one or more common data object aspects; and

outputting the first and second plurality of sets of encoded data slices for storage in the DSN based on the first and second plurality of sets of DSN addresses.

2. The method of claim **1** further comprises:

creating a record for the first data object in a common data object aspect database, wherein the record includes a data object identifier, information regarding the one or more common data object aspects, and a portions number indicating a number of portions constituting the first data object, wherein the common data object aspect database includes a plurality of records for at least some of the plurality of data objects.

3. The method of claim **1** further comprises:

the one or more common data object aspects is one of a plurality of common data object aspects that includes two or more of: a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object, data size of the data object, a data object type, a capturing unit ID that obtained the data object, and a vault ID.

4. The method of claim **1**, wherein generating a DSN address of the first plurality of sets of DSN addresses comprises:

generating a slice index field;

generating a data object aspect field;

generating a data object ID; and

generating a segment field regarding the at least a portion of the first data object.

5. The method of claim **1** further comprises:

decoding a decode threshold number of the first and second plurality of sets of encoded data slices for each data segment of the first and second data objects to produce a reconstructed data object;

analyzing the reconstructed data object to identify additional common data object aspects of the reconstructed data object with a third data object of the plurality of data objects;

disperse storage error encoding at least a portion of the reconstructed data object to produce a new set of encoded data slices;

generating a new set of DSN addresses for the new set of encoded data slices, wherein each of the new set of DSN addresses includes a field referencing the one or more common data object aspects and the additional common data object aspects; and

outputting the new set of encoded data slices for storage in the DSN based on the new set of DSN addresses.

6. The method of claim **1** further comprises:

dividing the first data object into a plurality of portions;

disperse storage error encoding the plurality of portions to produce another plurality of sets of encoded data slices;

generating another plurality of sets of DSN addresses for the other plurality of sets of encoded data slices, wherein DSN addresses of the other plurality of sets of DSN addresses includes a field referencing the one or more common data object aspects; and

outputting the other plurality of sets of encoded data slices for storage in the DSN based on the other plurality of sets of DSN addresses.

7. A method for retrieving data objects having a common aspect, the method comprises:

selecting, by a processing module of a computing device, one or more common data object aspects from a plurality of common data object aspects to produce selected common data object aspects;

accessing, by the processing module, a common data object aspect database based on the selected common data object aspects to identify a set of records, wherein a record of the common data object aspect database includes a data object identifier of a data object, information regarding one or more common data object aspects of the data object, and a portions number indicating a number of portions constituting the data object;

generating, by the processing module, a first plurality of sets of dispersed storage network (DSN) addresses based on a first data object identifier, the information regarding the one or more common data object aspects, and the portions number of a first record of the set of records;

retrieving, by the processing module, at least a decode threshold number of encoded data slices of a first plurality of sets of encoded data slices from the DSN based on the first plurality of sets of DSN addresses;

decoding, by the processing module, the at least a decode threshold number of encoded data slices of the first plurality of sets of encoded data slices in accordance with a dispersed storage error encoding function to reproduce a plurality of portions of a first data object;

generating, by the processing module, a second plurality of sets of dispersed storage network (DSN) addresses based on a second data object identifier, the information regarding the one or more common data object aspects, and the portions number of a second record of the set of records;

retrieving, by the processing module, at least a decode threshold number of encoded data slices of a second plurality of sets of encoded data slices from the DSN based on the second plurality of sets of DSN addresses; and

decoding, by the processing module, the at least a decode threshold number of encoded data slices of the second plurality of sets of encoded data slices in accordance with a dispersed storage error encoding function to reproduce a plurality of portions of a second data object.

8. The method of claim 7, wherein the plurality of common data object aspects comprises two or more of:

a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object, data size of the data object, a data object type, a capturing unit ID that obtained the data object, and a vault ID.

9. The method of claim 7, wherein generating a DSN address of the first and second plurality of sets of DSN addresses comprises:

generating a slice index field based on the dispersed storage error encoding function;

generating a data object aspect field based on the selected common data object aspects;

generating a data object ID based on the data object identifier; and

generating a segment field based on the portions number.

10. A capturing unit comprises:

a first module, when operable within a computing device, causes the computing device to obtain a plurality of data objects for storage in a dispersed storage network (DSN);

a second module, when operable within the computing device, causes the computing device to determine that two data objects of the plurality of data objects have one or more common data object aspects wherein each of the two data objects includes a plurality of data segments;

a third module, when operable within the computing device, causes the computing device to:

disperse storage error encode the plurality of data segments of a first data object of the two data objects to produce a first plurality of sets of encoded data slices, wherein a data segment of the plurality of data segments is dispersed storage error encoded into a set of encoded data slices of the first plurality of sets of encoded data slices and wherein a decode threshold number of encoded data slices of the set of encoded data slices in needed to recover the data segment; and

disperse storage error encode the plurality of data segments of a second data object of the two data objects to produce a second plurality of sets of encoded data slices;

a fourth module, when operable within the computing device, causes the computing device to:

generate a first plurality of sets of DSN addresses for the first plurality of sets of encoded data slices, wherein DSN addresses of the first plurality of sets of DSN addresses includes a field referencing the one or more common data object aspects; and

generate a second plurality of sets of DSN addresses for the second plurality of sets of encoded data slices, wherein DSN addresses of the second plurality of sets of DSN addresses includes the field referencing the one or more common data object aspects; and

a fifth module, when operable within the computing device, causes the computing device to output the first and second plurality of sets of encoded data slices for storage in the DSN based on the first and second plurality of sets of DSN addresses.

11. The capturing unit of claim 10 further comprises:

a sixth module, when operable within the computing device, causes the computing device to create a record for the first data object in a common data object aspect database, wherein the record includes a data object identifier, information regarding the one or more common data object aspects, and a portions number indicating a number of portions constituting the first data object, wherein the common data object aspect database includes a plurality of records for at least some of the plurality of data objects.

12. The capturing unit of claim 10 further comprises:

the one or more common data object aspects is one of a plurality of common data object aspects that includes two or more of: a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object, data size of the data object, a data object type, a capturing unit ID that obtained the data object, and a vault ID.

13. The capturing unit of claim 10, wherein the fourth module, when operable, generates a DSN address of the first plurality of sets of DSN addresses by:

generating a slice index field;

generating a data object aspect field;

generating a data object ID; and

generating a segment field regarding the at least a portion of the first data object.

14. The capturing unit of claim 10 further comprises:

a sixth module, when operable within the computing device, causes the computing device to decode a decode threshold number of the first and second plurality of sets of encoded data slices for each portion of the first and second data objects to produce a reconstructed data object;

the second module is further operable to analyze the reconstructed data object to identify additional common data object aspects of the reconstructed data object with a third data object of the plurality of data objects;

the third module is further operable to disperse storage error encode at least a portion of the reconstructed data object to produce a new set of encoded data slices;

the fourth module is further operable to generate a new set of DSN addresses for the new set of encoded data slices, wherein each of the new set of DSN addresses includes a field referencing the one or more common data object aspects and the additional common data object aspects; and

the fifth module is further operable to output the new set of encoded data slices for storage in the DSN based on the new set of DSN addresses.

15. The capturing unit of claim 10 further comprises:

the third module is further operable to:

divide the first data object into a plurality of portions; and

disperse storage error encode the plurality of portions to produce another plurality of sets of encoded data slices;

the fourth module is further operable to generate another plurality of sets of DSN addresses for the other plurality of sets of encoded data slices, wherein DSN addresses of the other plurality of sets of DSN addresses includes a field referencing the one or more common data object aspects; and

the fifth module is further operable to output the other plurality of sets of encoded data slices for storage in the DSN based on the other plurality of sets of DSN addresses.

16. A retrieving unit comprises:

a first module, when operable within a computing device, causes the computing device to select one or more common data object aspects from a plurality of common data object aspects to produce selected common data object aspects;

a second module, when operable within the computing device, causes the computing device to access a common data object aspect database based on the selected common data object aspects to identify a set of records, wherein a record of the common data object aspect database includes a data object identifier of a data object, information regarding one or more common data object aspects of the data object, and a portions number indicating a number of portions constituting the data object;

a third module, when operable within the computing device, causes the computing device to:

generate a first plurality of sets of dispersed storage network (DSN) addresses based on a first data object identifier, the information regarding the one or more common data object aspects, and the portions number of a first record of the set of records; and

generate a second plurality of sets of dispersed storage network (DSN) addresses based on a second data object identifier, the information regarding the one or more common data object aspects, and the portions number of a second record of the set of records;

a fourth module, when operable within the computing device, causes the computing device to:

retrieve at least a decode threshold number of encoded data slices of a first plurality of sets of encoded data slices from the DSN based on the first plurality of sets of DSN addresses; and

retrieve at least a decode threshold number of encoded data slices of a second plurality of sets of encoded data slices from the DSN based on the second plurality of sets of DSN addresses;

a fifth module, when operable within the computing device, causes the computing device to:

decode the at least a decode threshold number of encoded data slices of the first plurality of sets of encoded data slices in accordance with a dispersed storage error encoding function to reproduce a plurality of portions of a first data object; and

decode the at least a decode threshold number of encoded data slices of the second plurality of sets of encoded data slices in accordance with a dispersed storage error encoding function to reproduce a plurality of portions of a second data object.

17. The retrieving unit of claim **16**, wherein the plurality of common data object aspects comprises two or more of:

a time window aspect, a destination identifier (ID) of the data object, a source ID of the data object, one or more internet protocol (IP) addresses associated with the data object, a geographic location regarding the data object, data content information of the data object, data size of the data object, a data object type, a capturing unit ID that obtained the data object, and a vault ID.

18. The retrieving unit of claim **16**, wherein the third module is further operable to generate a DSN address of the first and second plurality of sets of DSN addresses by:

generating a slice index field based on the dispersed storage error encoding function;

generating a data object aspect field based on the selected common data object aspects;

generating a data object ID based on the data object identifier; and

generating a segment field based on the portions number.

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